CHAPTER 2
PROPOSED ACTION AND ALTERNATIVES

2.1 INTRODUCTION

This chapter describes the Wind Hunter, LLC proposed Valley County Wind Energy Project (VCWEP), and includes information regarding the project site and location, facilities, construction activities and costs, operation and maintenance activities, mitigation inherent in project design, and decommissioning. Also described are the no-action alternative, alternatives considered but eliminated, off-site alternatives, alternative routes for the transmission interconnection, and expected future activities.

2.2 PROJECT OVERVIEW

Wind Hunter, LLC, proposes to construct, operate and maintain a wind turbine electrical generation facility, in Valley County, Montana, approximately 29 miles north-northwest of the City of Glasgow (Figure 1.1). The VCWEP would consist of up to a 500-megawatt (MW) wind energy development, constructed in up to four (4) phases, and a 30-mile transmission interconnection with Western Area Power Administration (Western) adjacent to the existing Richardson Coulee Substation, owned by Northwestern Energy (formerly Montana Power Company), to a new substation known as Antelope Creek. The new substation will be constructed, operated, and maintained by Western.

The first phase of the VCWEP would construct and operate 33 wind turbines having a nameplate capacity of 1.5 MW, a total of 49.5 MW (nominally 50 MW). The VCWEP would be constructed on private lands leased (or in discussions for lease) for wind energy development, public lands managed by the Bureau of Land Management (BLM), and Montana State trust lands. A 69kV transmission line is also being considered as an alternative interconnection voltage for the first phase of the project.

A new gravel road, constructed to Valley County road standards, will be extended approximately two miles from Kerr Road into the collector substation and O&M facility of the VCWEP (Figure 2.3-2). New roads will also be required to construct and maintain the wind farm and transmission interconnection. A new substation and a system of overhead and underground 34.5kV electrical lines will be constructed within the wind farm to collect the power generated by the wind farm turbines and convert it to the voltage of the interconnection. An operations and maintenance (O&M) facility will also be located adjacent to the substation. Collectively, all of the facilities constructed and operated as part of the VCWEP are referred to as the Project.

The proposed 230kV transmission line would cross public land managed by the BLM, private land, and State of Montana trust land. The transmission line would utilize H-frame wood structures spaced 700-800 feet apart (depending on terrain). Transmission structures would be 65-75 feet tall. There would be 7 to 8 structures per mile. The proposed right-of-way is 100 to 125 feet in width. Alternative transmission line routes being considered are shown on Figure 2.4-5. The requested right-of-way grant from the BLM for the transmission line is for a period of 30 years with an option to renew.

There are several advantages in using wood pole structures: they are readily available; they can be installed using simple construction techniques; and, in emergencies, they can be easily modified or replaced to reduce outage time. New wood pole structures are typically buried 10 percent of the height of the structure plus 2 feet (i.e., a 65-75 foot structure would be buried 8.5 to 9.5 feet deep).

2.3 PROPOSED ACTION

The VCWEP would consist of wind turbine generators and associated electrical systems, underground and overhead electrical collector system, collector substation, transmission interconnection facilities, a new interconnection substation, meteorological towers, access roads and an O&M building (Figure 2.3-1). Each of these features is described in more detail below. The wind farm would be constructed in phases:

- Phase I – 33 turbines (50 MW) in operation by 2007
- Phase II – 63 turbines (100 MW); 2010
- Phase III – 104 turbines (150 MW); 2013
- Phase IV – 134 turbines (200 MW); 2016

Construction of the first phase would begin in the spring of 2006. Figure 2.3-2 illustrates the general site layout of the first phase of the Project. The facility, once constructed, would operate year round. An approved Plan of Development (POD) would be required by the BLM prior to authorizing construction of each of the phases.

2.3.1 Description of the Proposed Facilities

The study area was chosen primarily for its robust wind resource suitable for producing electricity at competitive prices and access to Western's transmission system that has adequate capacity to allow the first phase of wind generated power to be integrated into the interconnected transmission system. Other factors considered were site accessibility, surrounding land use compatibility, and a proven wind resource suitable for producing electricity at competitive prices. These combined factors rendered the proposed site the most practical and feasible from a technical and economic standpoint (also refer to Section 2.4.2 for a discussion of alternatives considered and eliminated). In addition, the BLM's Wind Programmatic Draft EIS shows this area as a suitable site for development on public lands managed by the BLM.

2.3.1.1 Wind Generating Facilities

The VCWEP is located on open, flat ridge tops approximately 30 miles northwest of the City of Glasgow in Valley County, Montana. It would be located on a combination of privately owned rangeland and cultivated agricultural lands (pursuant to leases negotiated between the landowner and Wind Hunter), public lands (rangeland) managed by the BLM, and Montana State Trust Lands (also rangeland). Strong winds blow out of the

Figure 2.3-1 Wind Farm Phases

Figure 2.3-1 Phase 1 Preliminary Layout

northwest nearly 70% of the year, and from the southeast approximately 30% of the time. Wind measurements (i.e., speed, duration, and direction) have been monitored using a 40-meter since January 2004. A 60-meter meteorological tower was installed in September 2004.

A drainage divide (Bitter Creek and Buggy Creek) defines the eastern edge of the adjacent Bitter Creek Wilderness Study Area, and the Phase I eastern edge of the wind farm. The highest ridges in the area range from approximately 2900 feet to above 3,100 feet in elevation. The first phase would occupy approximately 1,094 acres and was determined by the available 50 MW capacity available in Western's existing Fort Peck to Havre 161kV transmission line, and the Transmission Service Agreement for firm transfer between Wind Hunter and Western. The first phase of the Project would install and operate 33 three-bladed 1.5 MW wind turbines.

The future three phases of the Project would also be located on a combination of private, BLM, and State of Montana lands to the east of the Phase I area described above. Wind Hunter has secured a lease to explore and develop wind energy exists on some of the private lands, and are in discussions with other interested landowners in the area. These private leases would allow construction and operation of wind facilities for specific stipulated terms. In exchange, each landowner leasing property would receive financial compensation.

Phase II of the Project would install an additional 100 MW of wind power capacity, or approximately 63 more turbines. This phase would occupy approximately 2,800 acres. Wind Hunter expects that additional capacity will become available by 2010 on the Fort Peck to Havre transmission line if the substations owned by Northwestern Energy can be upgraded to accommodate the line being energized to 230kV from its current voltage of 161kV.

Phase III would add 150 MW of wind power capacity, or approximately 104 1.5 MW wind turbines. This phase would bring the total wind farm capacity to 300 MW and would occupy approximately 5,520 acres. Wind Hunter expects that by 2013 a new transmission line or additional upgrades will allow the required transmission service.

Phase IV would install 200 MW additional (for a total of 500 MW), or approximately 134 more 1.5 MW wind turbines. This phase would occupy approximately 10,706 acres. Wind Hunter expects Western's transmission system to be able to accommodate this additional firm transmission service by 2017.

The phasing plan is a reasonable foreseeable approach to developing the VCWEP, however economic and other factors that will change in the future will result in modifications to this phasing concept. As such, Wind Hunter will seek the approval of the lead and cooperating agencies to approve any modifications to the project phasing prior to construction activities commencing.

The VCWEP would install and operate three-bladed 1.5 MW wind turbines on tubular conical steel structures. The height of the turbines (referred to at the "tip height") would range from 330 feet to 390 feet from the ground to the blade tip in its highest position, depending on the type and size of the turbine selected. The final selection of the exact make and model of wind turbine to be used for the project depends on current technological changes, financial factors, equipment availability, and other factors. Areas around each wind tower would be disturbed temporarily during construction.

A new primary access road and new internal wind farm roads would be constructed along the turbine strings for constructing, operating and maintaining the wind turbines and associated equipment. The VCWEP would permanently occupy approximately 113.8 acres. Approximately 523.5 acres would be temporarily occupied during construction by materials and equipment, such as staging and laydown areas. Table 2.3-1 summarizes the proposed facilities and the total area that would be permanently and temporarily occupied by the VCWEP.

Overhead and underground electrical lines (34.5kV) would be installed in circuits to collect the power generated in turbine strings to the wind farm substation (Figure 2.3-3). Lines between individual wind turbines would generally be located underground, and single or double-circuit overhead lines would generally connect the circuits back to the collector substation.

One O&M facility, approximately 5,000 square feet on an approximately 2-acre site, also would be constructed. The facility would combine operation facilities, offices, and a maintenance and storage component. Outside storage space for spare equipment will also be required.

The expected life of the wind farm is approximately 20 years. The design life of major project equipment such as the turbines, transformers, substations and supporting plant infrastructure is at least 20 years. The trend in the wind energy industry has been to re-power older wind projects by upgrading older equipment with more efficient turbines. It is likely that after mechanical wear takes its toll, the project could be upgraded with more efficient equipment and could have a useful life longer than 20 years.

Table 2.3-1 Ground Disturbance By Phase – Valley County Wind Energy Project

General Information	**Phase I**		**Phase II**		**Phase III**		**Phase IV**		**Proposed Action - Disturbance Totals**	
Number of Turbines	33		63		104		134		334	
Acres	1094		2800		5520		10706		20120	
Power Generated (MW)	50		100		150		200		500	
Acres Disturbance by Type	**Temp**	**Perm**	**Temp**	**Perm**	**Temp**	**Perm**	**Temp**	**Perm**	**Temp**	**Perm**
Operations Building	2.0	2.0	0.0	0.0	0.0	0.0	0.0	0.0	2.0	2.0
Collector Substation	1.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	1.0	1.0
Access Road	8.7	5.8	0.0	0.0	0.0	0.0	0.0	0.0	8.7	5.8
Internal Road Network	3.5	10.4	7.0	20.8	10.5	31.2	14.0	41.6	35.0	104.0
Wind Turbines	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.4	1.0	1.0
Turbine Pads	7.6	0.0	15.2	0.0	22.8	0.0	30.4	0.0	76.0	0.0
Material Staging	33.0	0.0	66.0	0.0	99.0	0.0	132.0	0.0	330.0	0.0
Collector System	7.0	0.0	14.0	0.0	20.9	0.0	27.9	0.0	69.8	0.0
Total	**62.9**	**19.3**	**102.4**	**21.0**	**153.5**	**31.5**	**204.7**	**42.0**	**523.5**	**113.8**

- Calculations are based on the phase as it stands alone (50, 100, 150, 200)
- Calculations are based on megawatt comparisons between phases (Phase II is 2x larger than Phase I)

First Phase Assumptions

New access road will be 2.0 miles long and 24 feet wide; 60 ROW disturbed temporarily

Internal Wind Farm Roads will be 4.8 miles long and 18 feet wide; 3 feet on either side temporary disturbed

Collector system installation will not require new roads; overland travel for construction; 4.8 miles

Wind turbine towers are 14 feet in diameter at the base; 154 square feet permanently removed

Operations building 2000 square feet; 2.0 acres of parking and outside storage

Collector substation - 1 acre within the fence and another acre temporarily disturbed

Collector System - 3.5 mile UG; 1.3 miles OH; 12 feet wide disturbed area for access; no blading

Wind Turbines

Wind turbines consist of three main components: the turbine tower, nacelle (machine house) and rotor blades. A typical wind turbine tower and dimensions are shown in Figure 2.3-3. Figure 2.3-4 shows an illustration of a typical modern three-blade upwind turbine generator. The nacelle is the portion of the wind turbine mounted at the top of the tower, which houses the wind turbine, the rotor, hub and gearbox (Figure 2.3-5). The 1.5 MW wind turbine under consideration for the project has the design features shown in Table 2.3-2.

Table 2.3-2 Wind Turbine Features, Valley County Wind Energy Project

Design Feature	Description
Rated output of turbine	1.5 MW
Number of turbines (Phase 1) Future Phases	Phase 1-34 Future Phases: 145 to 175
Axis	Horizontal
Rotor Orientation	Upwind
Minimum wind speed for turbines to begin operating	7-10 miles per hour (1)
Number of blades	Three
Rotor (blade) diameter	200 to 230 feet
Tower type	Tubular Steel
Tower hub (nacelle) height	215 to 260 feet
Total (tip) height (to top of vertical rotor)	330-390 feet
Rotational speed	10—23 rotations per minute
Nacelle	Fully enclosed steel or steel reinforced fiberglass
Color	Neutral gray

(1) Wind turbines rotate in winds as low as 2-3 mph, but generator cut in occurs at 7-10 mph

Figure 2.3-3 Typical Wind Turbine

Figure 2.3-4 Typical Modern Three-Bladed Upwind Turbine Generator

Figure 2.3-5 Typical Nacelle

Figure 2.3-6 Tower Erections

Figure 2.3-7 Setting the Nacelle

Figure 2.3-8 Flying the Rotor

Towers

Towers would be approximately 215 to 260 feet tall at the turbine hub (referred to as the “hub height”). With the nacelle and blades mounted, the total height of the wind turbine (“tip height”) would be approximately 330 to 390 feet high with a blade in the vertical position. The tower would be a tubular conical steel structure manufactured in multiple sections depending on tower height and approximately 12 to 16 feet in diameter at the base. The towers would be painted a neutral gray color to be visually less obtrusive. A service platform at the top of each section would allow for access to the tower’s connecting bolts for routine inspection. A ladder inside the structure would ascend to the nacelle to provide access for turbine maintenance. The tower would be equipped with interior lighting and a safety cable alongside the ladder.

The tower would be fabricated and erected in two to three sections (Figure 2.3-6). Turbine tower sections would be transported to the site on trailers that could carry one tower section per truck. Tower sections would be delivered by truck to a staging area and then to each tower location. They would be erected using a large construction crane.

Nacelle

The nacelle houses the main mechanical components of the wind turbine generator—the drive train, gearbox, and generator. The nacelle would be equipped with an anemometer and a wind vane that signals wind speed and direction information to an electronic controller. A mechanism would use electric motors to rotate (yaw) the nacelle and rotor to keep the turbine pointed into the wind to maximize energy capture. An enclosed steel-reinforced fiberglass shell houses the nacelle to protect internal machinery from the elements and to dampen noise emissions. Figure 2.3-7 is a photograph of a crane setting the nacelle.

Rotor Blades

Modern wind turbines have three-bladed rotors. The diameter of the circle swept by the blades would range from approximately 200 to 230 feet that is each blade would be approximately 100 to 115 long. The blades would turn at about 10 to 23 revolutions per minute (RPM). Generally, larger wind turbine generators have slower rotating blades, but the specific RPM values depend on aerodynamic design and vary across machines. The rotor blades would be typically made from glass-reinforced polyester composite. Figure 2.3-8 is a photograph of the installation of a three-bladed rotor, typically referred to as “flying the rotor.”

Electrical System

The projects electrical system would have two key elements: (1) a collector system, which would collect energy between 575 and 690 volts (V) from each wind turbine (depending on the type of turbine used), increase it to 34.5kV through a pad mounted transformer, and connect to the project substation; and (2) the substation and interconnection facilities which would transform the energy from the collection lines (at 34.5kV) to the transmission voltage of 161kV for transmission to Western point of interconnection. A schematic of the electrical collection system and interconnection facilities is shown in Figure 2.3-9.

Collector System

Power from the wind turbines would be generated at 575V to 690V depending on the specific type of wind turbine used for the project. A set of heavy gauge, armored, flexible drop cables would connect the generator terminals in the nacelle and would pass from the nacelle into the tower where they would drop down to a cable support saddle located 20 to 30 feet below the top of the tower platform. From the support saddle, the cables would be directed along the side of the tower, along the internal cable trays, or would be hung straight down to the base bus cabinet and breaker panel inside the base of the tower. The drop cable would terminate inside the bus cabinet. Another set of cables would run from the bus cabinet through conduits in the foundation to the pad transformer, ranging in size from 50 to 120 square feet in area; the pad transformer would step up the voltage to 34.5kV (Figure 2.3-10).

From the transformer, power from the turbine would be transmitted by underground 34.5kV electrical cables installed in a trench typically 3 to 4 feet deep, depending on the underlying soil and rock conditions, and up to 5 feet wide. Underground collection cables would be used in most areas; overhead collectors on wood structures would be used where there are steep slopes or canyons to cross (see Figure 2.3-1, Typical Underground Cable Trench).

The electrical collection system would include junction boxes and pad-mounted switchgear panels that would be installed to connect cables coming from different directions and to allow for the isolation of particular turbine strings.

Junction Boxes

The junction boxes would be either steel clad or fiberglass panel mounted on pad foundations roughly 4 feet wide, 6 feet long and 6 feet high. The pad foundation would have an underground vault about 3 feet deep where the underground cables come in. The junction boxes also would have a buried grounding ring with grounding rods tied to the collection system and a common neutral

Switch Panels

The switch panels would be steel-clad enclosures mounted on pad foundations roughly 7 feet wide, 7 feet long and 5 feet high. Switches would allow particular collector lines and turbine strings to be turned off or isolated. This isolation would allow maintenance and repair to take place without shutting down the entire project. The pad foundation would have an underground vault about 3 feet deep where the underground cables come in. Switch panels also would have a buried grounding ring with grounding rods tied to the collection system and a common neutral.

Figure 2.3-9 Electrical and Communications System

Figure 2.3-10 Typical Pad Mounted Transformer

Figure 2.3-11 Typical Underground Cable Trench

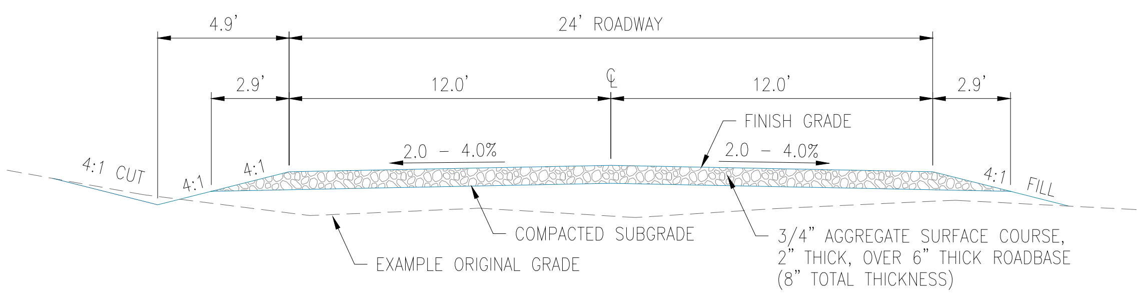
Meteorological Towers

Meteorological towers are used to measure wind conditions, including wind speed, direction and temperature. To date, Wind Hunter has installed 3 permanent meteorological towers in the project area. The locations of the meteorological towers are shown on Figure 2.3-2. The existing meteorological towers installed for the project would consist of a 40-meter tower (131 feet) and two 60-meter towers (197 feet). The towers consist of a central lattice structure supported by three to four sets of guy wires that extend up to 100 to 200 feet from the base of each tower on a 16-foot-by-16-foot base. The meteorological towers monitor wind strength and will be used to confirm turbine performance. Meteorological towers greater than 200 feet in height would require lighting in compliance with the Federal Aviation Administration (FAA) aircraft safety lighting requirements.

Access Roads

A new 24 feet-wide gravel road to access the wind farm facilities would be constructed between Kerr Road and the proposed collector substation at the wind farm, a distance of approximately 2 miles. The roadway design would include a compacted gravel surface and shoulders (Figure 2.3-12).

Figure 2.3-12 Access Roadway Cross Section



A new intersection at Kerr Road approximately one mile north of the Northern Border Pipeline compressor station would be required. The road would be constructed to the road standards and specifications of Valley County, and is expected to be petitioned to be included into the Valley County Road System. In areas of steeper grades, the design would maintain grades below 15% to prevent erosion and sediment loading into local drainages. The new primary access road would be open to use by the general public.

Access to the various rows of turbines and other wind farm facilities would be achieved by new 18-foot-wide graveled roads (refer to Figure 2.3-13). The Project would improve some existing private roads and construct new roads to provide access for construction vehicles and equipment. Phase I development will require 4.8 miles of new roads to be constructed. The internal wind farm roads would accommodate two-lane traffic and have a compacted gravel surface. In areas of steeper grades, the grades would be kept below 15% to prevent erosion and sediment loading into local drainages. After the project is constructed, use of the improved and new access roads within the wind farm would be controlled with barbed wire fencing and cattle guards.

Operation and Maintenance Facility

A permanent O&M facility would be constructed near the wind farm substation (refer to Figure 2.3-2. It would consist of approximately 5,000 square feet of enclosed space, including offices, spare parts storage, kitchen, restrooms and a shop area. Water for the bathroom and kitchen would be obtained from a new domestic well; anticipated water use would be less than 1,000 gallons per day. Wastewater from the facility would be discharged to an onsite domestic septic tank. There also would be graveled outdoor parking, a turnaround area for larger vehicles, outdoor lighting and gated access with either partial or full perimeter fencing. The overall area of the building and parking would be approximately 2 acres.

Safety Features and Control Systems

Turbine Control Systems

Wind turbines would be equipped with sophisticated computer control systems that would constantly monitor variables such as wind speed and direction, air and machine temperatures, electrical voltages, currents, vibrations, blade pitch and yaw angles. The main function of the control system would be nacelle and power operations. Generally, nacelle functions include yawing the nacelle into the wind, pitching the blades, and applying the brakes if necessary. Power operations controlled at the bus cabinet inside the base of the tower include operation of the main breakers to engage the generator with the grid as well as control on ancillary breakers and systems. The control system would always run to ensure that the machines operate efficiently and safely.

Each turbine would be connected to a central Supervisory Control and Data Acquisition (SCADA) system. The SCADA system would allow for remotely controlling and monitoring individual turbines and the wind plant as a whole from both the central host computer or from a remote personal computer. In the event of faults, the SCADA system can also send signals to a fax, pager or cell phone to alert operations staff. The turbine towers and foundations would be designed to survive a gust of wind more than 90 miles per hour (mph) with the blades pitched in their most vulnerable position.

Braking Systems

The turbines would be equipped with two full independent braking systems that can stop the rotor either acting together or independently. The braking system is designed to be fail-safe, allowing the rotor to be brought to a halt under all foreseeable conditions.
The system would consist of aerodynamic braking by the rotor blades and a separate hydraulic disc brake system. Both braking systems would operate independently such that if there is a fault with one, the other can still bring the turbine to a halt. Brake pads on the disc systems would be spring loaded against the disc and power would be required to keep the pads away from the disc. If power is lost the brakes would be mechanically activated immediately. The aerodynamic braking system also would be configured such that if power is lost it would be activated immediately using back-up emergency power or nitrogen accumulators on the hydraulic system, depending on the turbine design.

Figure 2.3-12 Access Roadway Cross-Section

Figure 2.3-13 Wind Farm Graveled Roadway

Typical Built-In Fire Safety

Each turbine's nacelle would be equipment with an internal fire detection system with sensors located in the nacelle as well as at the tower base. The fire detection system would be connected to the main controller and the central SCADA system. In the event of a fire, the turbine would be immediately halted and an alarm activate in the control system that can send a page or message to a cell phone of the on-call operators

Lightning Protection

The turbines would be equipped with an engineered lightning protection system that connects the blades, nacelle, and tower to a grounding system as the base of the tower. The grounding system would include a copper ring conductor connected to grounding rods driven down into the ground at diametrically opposed points outside the tower foundation. The system would provide a firm grounding path to divert harmful stray surge voltages away from the turbine. The blades would be constructed with an internal copper conductor and an additional lightning rod that extend above the wind vane and anemometer at the rear of the nacelle; both would have conductive paths to nacelle bed frame, which in turn would connect to the tower.

Lighting

In compliance with the FAA's aircraft safety lighting requirements, project turbines, as well as meteorological towers greater than 200 feet tall, would be marked with lights that flash white during the day (at 20,000 candela) and red at night (at 2,000 candela). The lights would be designed to concentrate the beam in the horizontal plane, minimizing light diffusion downward toward the ground and upward toward the sky. After it has reviewed final project plans, the FAA would specify the exact number of turbines that would require lighting. Under current FAA regulations, the navigation lights would need to be mounted on the first and last turbine of each string and every 1,000 to 1,400 feet in between.

The substation and O&M facility would be equipped with nighttime and motion sensor lights for safety and security. Sensors and switches would be used to keep lights off when not required. Emergency lighting with back-up power is included to allow personnel to perform manual operations during an outage of normal power sources.

Cost Estimate

Capital cost of construction for each phase of VCWEP development is shown in Table 2.3-3.

Table 2.3-3 Estimated Construction Costs of VCWEP

Phase	Estimated Capital Construction Cost (in millions)
Phase I – 50 MW	$ 54
Phase II – 100 MW	$103
Phase III – 150 MW	$160
Phase IV – 200 MW	$203

2.3.1.2 Transmission Interconnection Facilities

Power generated by the wind turbines will be delivered into the Western grid from the on-site step up transformer to a new 30-mile 230kV transmission to be constructed by Wind Hunter to a new substation to be constructed by Western, known as Antelope Creek located just east of NWE's Richardson Coulee substation. Figure 1-1 shows the location of the wind farm and the Western substation site and the area studied for locating a route for the transmission line. The proposed 230kV transmission line would be energized initially at 161kV to match the voltage of Western's transmission system.

The proposed 230kV transmission line would cross BLM-administered public land. An application for right-of-way grant has been submitted to the BLM. The transmission line would utilize H-Frame wood structures, spaced approximately 700-800 feet apart (depending on terrain). Transmission structures would be 65-75 feet in height. The proposed right-of-way would be 100 to 125 feet in width. The request for right-of-way grant is for a period of 30 years with the option to renew.

Construction of the transmission line would proceed in parallel with construction of the wind turbines, beginning in the spring of 2006 and completed and operational in by September 2006. The expected life of the transmission line is 100 years assuming one replacement of the wood pole structures. Prior to construction, a Plan of Development (POD) would be developed. The POD would outline the specifics of how the proposed project would be constructed and operated and list environmental mitigation and protection plans and monitoring measures to ensure all commitments are fulfilled. Construction of the transmission line is expected to cost about $8.8 million.

Structures

The design, construction, operation and maintenance of the 230kV transmission line would meet or exceed the requirements of the National Electrical Safety Code (NESC), U.S. Department of Labor, Occupational Safety and Health Standards and Westland Wind requirements for safety and protection of landowners and their property. Ground wire having fiber optic capability may be installed rather than traditional ground wire in order to facilitate future project communication needs without additional ground disturbance. Electrical design characteristics of the proposed 230kV transmission facilities are shown in Table 2.3-4.

Table 2.3-4 Electrical Design Characteristics of the Proposed Project

Feature	Description
Line Length	Approximately 30 miles
Type of Structure	Wood pole, H- Frame
Structure Height	65-75 feet
Span Length	700 to 800 feet (depending upon terrain)
Number of Structure per Mile	7 to 8 per mile
Transmission Line ROW	100 to 125 feet
Structure Work Areas	Tangent 50 feet x 75 feet Deadends 150 feet x 150 feet
Structure Base Dimension	4 feet x 25 feet
Land Temporarily Disturbed for Conductor Reel and Pole Storage Yard	5-10 acres
Land Required for Each Tower Base	100 square feet
Pulling/tensioning Sites	12- 100 feet x 300 feet
Access Roads	14 feet travel way- estimated 20 miles
Voltage 1) Design 2) Initial Operation	 230,000 volts (230kV) 161,000 volts (161kV)
Capacity (MW)	300 MW
Thermal Capacity 1) 230kV operation 2) 161kV Operation	 300 MVA 210 MVA
Circuit Configuration	Single circuit per structure, Single conductor per phase Horizontal configuration
Conductor Size/Type	1272 kcmil (1.3 inches) ACSR (aluminum conductor, steel Reinforced) non-specular finish
Maximum Anticipated Electrical Field At Edge of ROW	1.5kV/m
Maximum Anticipated Magnetic Field At Edge of ROW	50 MW (126 Amps) 10 milliGauss (mG) 500 MW (1,255 Amps) 102 milliGauss (mG)
Minimum Ground Clearance of Conductor	26 feet

Table 2.3-5 summarizes the area that would be temporarily disturbed by transmission line construction and permanently occupied by transmission line structures and access roads.

Table 2.3-5 230kV Transmission Line Temporary and Permanent Disturbance

Temporary Feature	Temporary Disturbance
Structure Work Area-Tangent	50 ft x 75 ft (3,750 square feet)
Structure Work Area- Deadend	150 ft x 150 ft (22,500 square feet)
Conductor Reel and Pole Storage Yard	5 to 10 acres
Pulling/ Tensioning Sites	12 sites, 100ft x 300ft (30,000 square feet each- .68 acres each site) (360,000 square feet total-8.26 acres total)
Permanent Feature	**Permanent Disturbance**
Land for Each Structure Base	4 ft x 25ft (100 square feet)
Estimated Total Land Occupied By Structures (7 to 8 structures per mile x 35 miles)	24,500 square feet to 28,000 square feet (.56 acre-.64 acre)
Access Roads (14 feet wide estimated 20 miles required)	34 acres

H-frame wood pole structures, with two overhead ground-wires would be used for construction of the proposed 230kV transmission line. Generally, structures would be placed in two holes augered in the ground and backfilled. Design characteristics of the transmission line are shown in Figures 2.3-14 and 2.3-15 show typical H-frame structures. Spacing between the structures would be between 700 to 800 feet depending on terrain. There would be between 7 and 8 structures per mile. Three-pole dead-end structures would be used for longer spans. Typical structure heights would range from 65 to 75 feet. Structure base dimension would be 4 feet x 25 feet.

Electrical conductors provide the medium for the flow of electrical energy. The circuit configuration and conductor size are shown in Table 2.3-4. The conductor would consist of strands of reinforced steel cable encased by aluminum strands. The steel cable provides the tensile strength to support the conductor, the aluminum carries the electrical current.

Insulators and hardware used on the line would be standard design and should provide nearly corona-free operation and reduce audible noise and interference with radio transmission. Insulators for the 230kV transmission line would be hung from the structure. Each string would have 12 to 13 insulators. Two overhead ground-wires, approximately three-eights of an inch in diameter, would be installed at the top of the structure to provide protection to the conductor from direct lightning strikes.

Right of Way

In general, new land rights would be required for the transmission line facilities, including the transmission line ROW and access roads. A ROW application was submitted to the BLM in July 2004. The proposed ROW would be between 100 and 125 feet wide. Master Title Reports, Master Title Plats and Mining Claims Reports will be included in the Plan of Development (POD) submitted prior to construction. ROWs for

Figure 2.3-14 Wood Pole H-Frame Tangent Structure

Figure 2.3-15 Three Pole Dead-End Structure

Figure 2.3-16 Proposed Antelope Creek Substation

Figure 2.3-17 Spread Footing Type Foundation

transmission line facilities on non-federal lands would be obtained in perpetual easements. Every effort would be made to purchase all the land rights on private lands through reasonable negotiations with present owners.

Work Areas

Work area of approximately of 50 feet by 75 feet for tangent structures and 150 feet by 150 feet for dead end structures would be required at structure locations to facilitate the safe operation of equipment and construction operations. Within these work areas, the permanent disturbance associated with each structure base foundation would be 4 feet by 25 feet. The land required for each tower base is estimated at 100 square feet. Land temporarily disturbed for conductor reel and pole storage would be 5 to 10 acres.

The work area outside of the permanent disturbance would be cleared of vegetation only to the extent necessary to allow equipment to maneuver. Grading would only occur where the topography was too steep or uneven to allow safe equipment operation. After line construction all work areas would be restored.

Pulling and tensioning sites for stringing the conductor would result in an additional temporary disturbance of 100 feet by 300 feet with an estimated 12 sites required for the entire transmission line.

Access Roads

The proposed project would use existing roads and trails wherever feasible for access to minimize new disturbance. An estimated 20 miles of new or improved roads would be required. Some of the access roads would be located with the 100 to 125 foot ROW for the transmission line. However portions of the access roads would need to be located outside the ROW. Temporary disturbance would be approximately 14 feet wide for the access roads. Roads constructed in terrain exceeding 30% slope and along narrow terraces would cause more temporary disturbance.

Access roads would be used during construction to access work areas and during periodic maintenance of the completed transmission line throughout the life of the proposed Project. Access roads would be revegetated with grass and forb species following construction, but the road prism would remain intact for access during routine patrols and maintenance activities.

2.3.1.3 SUBSTATIONS

Two substations will be required for the project; a collector substation at the wind farm and an interconnection substation for the Fort Peck to Havre 161kV transmission line.

The proposed interconnection substation site would be located west of Glasgow on Billlingsley Road, and on the east side of the existing Northwestern Energy’s Richardson Coulee Substation. The proposed 5 acre-site is privately owned and sits in flat topography. The site would be purchased by Western for the substation. It is currently rangeland used for grazing cattle. No cultivated agriculture is present in this location. The proposed acreage is undeveloped, and the nearest residence is approximately ½ mile away. The approximately 5-acre site would be developed and fenced to accommodate the new substation.

The predominant vegetation community is sagebrush steppe. The existing Billingsley Road, which provides access to the existing Richardson Coulee Substation and the proposed Antelope Creek Substation, is a gravel road on the Valley County Road system. Figure 2.3-16 illustrates the vicinity in which the substation would be located.

The proposed collector substation would be located approximately 30 miles northwest of Glasgow within the wind farm area and near Kerr Cow Camp. The fenced area of the collector substation would occupy between 2 and 5 acres, and would be located on private lands currently under lease for wind development. Access to the substation would be provided by a new improved gravel road that would be petitioned, as part of this process, to become part of the Valley County Road system. The site is currently rangeland used for grazing cattle. No residences are located within several miles in any direction.

Antelope Creek Substation

The new substation will provide the interconnection between the proposed Valley County Wind Energy Center and the Fort Peck to Havre 161kV transmission line. Western has concluded in a System Impact Study and Facility Study that a five-breaker 230kV main and transfer bus substation would be required to provide a reliable interconnection for the wind farm. New equipment in the substation will include 230kV bus work, circuit breakers, a power transformer, reactive compensation, related substation equipment, a control building, in addition to requisite control, protection and communication equipment, and transmission line approach spans and structures.

The interconnection line from the wind farm would interconnect to the proposed Antelope Creek Substation at 161kV. The new substation will include a three-phase autotransformer with a convertible 230-161kV winding on the high side, a 69kV low voltage winding, and 13.8kV tertiary. The transformer provides a low-voltage alternative for the required voltage support and a source of station power. It was determined by Western through cost analysis that the addition of the power transformer provided cost benefits by providing capacitance and reactance to the overall power system. Additional shunt capacitors will be required on the transmission line, possibly at the Malta Substation. Shunt reactance is also required on the transmission system, also likely at the Malta Substation. New metering equipment would also be required at the Antelope Creek Substation.

The proposed new Antelope Creek Substation would initially include the interconnection line’s termination structures, approximately 80-100 feet in overall height, 161kV circuit breaker. Substation high-voltage equipment would be an air-insulated type, requiring electrical bus, disconnecting switches, insulators and instrument transformers. Galvanized steel structures and reinforced concrete foundations would support all substation high voltage equipment.

The site development plans and equipment layouts would be based on a conceptual ultimate substation configuration. The new substation site would require excavation, grading and other site improvements to accommodate the required equipment. The substation would require a fenced site area of approximately 5 acres. Undeveloped area outside the substation fence would be utilized to route the transmission lines into the substation.

Other equipment required at the new substation would include a single-story control building approximately 40 x 40 feet. The surface of the substation within the fenced area would be covered with approximately six inches of crushed rock surfacing, and have gravel drive areas to accommodate the electrical operation and maintenance requirements and to provide ingress and egress for the major electrical equipment described above. Substation area lighting may be provided. Restoration using native seeding would be employed to stabilize any manufactured slopes and prevent erosion.

Collector Substation

The collector substation would require two 5 MVAR capacitor banks 13.8kV bus and 161/230kV autotransformer, and fiber optic communications between the wind farm collector substation and Antelope Creek Substation. Wind Hunter would also be required to meet the communication and protection requirements at the collector substation for reliable operation of the wind generators, the collector station capacitor banks, the collector substation equipment, and associated equipment.

2.3.2 Construction Activities

Project construction would be performed in several stages and would include the following main activities:

- Grading the field construction office and substation areas (also used for the O&M facility)
- Constructing site roads, turnaround areas, and crane pads at each wind turbine location;
- Constructing turbine tower foundations and transformer pads
- Installing the electrical collection system—underground and overhead lines
- Constructing and installing the substation
- Transporting and assembling the wind turbines
- Commissioning and energizing the plant and,
- Cleaning up the site

Wind Hunter would enter into two primary agreements for project construction including an agreement for the supply, erection and commissioning of the wind turbines as well as an engineering, procurement, and construction (EPC) contract for all other project facilities and infrastructure such as roads, electrical collection system, substation and O&M facility.

Table 2.3-6 lists the estimated type number and duration of construction equipment needed during project construction. Project construction would require approximately the same type and duration of equipment for Phase I 50 MW and subsequent phases for full build out of 500 MW. The number of pieces of equipment shown in the table is for construction of 104 turbines, 150 MW. The number of pieces of equipment would be less for Phase I 33 turbines, 50 MW.

Table 2.3-6 Estimated Type, Number and Duration of Project Construction Equipment

Construction Phase	Estimated Average Number of Vehicles On Site Daily During Construction	Estimated Duration (Months)
Site Preparation and Road Construction		
Bulldozer	4	3
Dump truck	10	3
Excavator	4	3
Front end loader	4	3
Motor grader	4	3
Vibratory roller	3	3
Water truck	5	8
Foundations		
Backhoe	4	4
Crane and boom truck	3	4
Concrete pump truck	2	4
Concrete truck	8	4
Drill rig	3	4
Dump truck	6	4
Trackhoe excavator	5	4
Front end loader	3	4
Small loader	3	4
Transportation truck-materials	6	4
Electrical		
Cable spool truck	3	4
Concrete truck	3	4
Boom truck	2	4
Fork truck to offload spools	2	4
Man lift bucket	2	4
Transportation truck-materials	8	4
Winch truck	3	4
Substation and Interconnect		

Construction Phase	**Estimated Average Number of Vehicles On Site Daily During Construction**	**Estimated Duration (Months)**
Backhoe	3	3
Bulldozer	2	3
Concrete truck	4	3
Drill rig	2	3
Dump truck	4	3
Man lift bucket truck	2	3
Trencher	2	3
Winch truck	1	3
Excavator	2	3
Wind Turbine Assembly and Erection		
Boom truck	4	4
Forklift	4	4
Rough terrain crane	4	4
Transportation truck-materials	20	4
Truck mounted crane	4	4
Project Clean-up		
Dump truck	2	2
Front end loader	2	2
Motor grader	2	2
Transportation truck-materials/waste	3	2

2.3.2.1 Wind Farm

Field Survey and Geotechnical Investigation

Before construction can commence, a site survey would be performed to identify the precise location of the wind turbines, site roads, electrical cables, access entryways and substation areas. Once the surveys are complete, a detailed geotechnical investigation would be undertaken to identify subsurface conditions that would dictate much of the design work of the roads, foundations, underground trenching, and electrical grounding systems. Typically the geotechnical investigation involves a drill rig that bores to the required depths (typically 8-inch diameter drill, 30 to 40 feet) and a backhoe to identify subsurface soil and rock types and strength properties by sampling and lab testing. Testing also would be conducted to measure the soil's electrical properties to ensure proper grounding system design. A geotechnical investigation would be performed at each turbine location at the substations and at the O&M facility.

Design and Construction Specifications

Using data gathered for the project including geotechnical information, site-specific environmental and climatic conditions and site topography, Wind Hunter’s engineering contractor would establish a set of site-specific construction specifications for various portions of the project. The design specifications would be based on established sets of construction standards set forth by standard industry practice groups such as the American Concrete Institute, Institute for Electrical and Electronic Engineers, national Electric Code, National Fore Protection Agency, and Construction Standards Institute. The design and construction specifications would be custom tailored for site-specific conditions by technical staff and engineers. The project engineering team also would ensure that all aspects of the specifications as well as the actual onsite construction, comply with applicable federal, state and local codes and good industry practice. The project would be designed and constructed to meet the minimum 20-year design life.

Access Roads and Staging Areas

Construction activities would begin with site preparation, including construction project access entryways from public roads. The project roads would have a gravel surface. Road construction would be performed in multiple phases starting with rough grading and leveling roadway areas. Once rough grade is achieved, base rock would then be spread over the road base and compacted to the finished grade.

Once heavy construction is complete, a final pass would be made with the grading equipment to level out road surfaces, and more capping rock would be spread and compacted in areas where needed. Water bars, similar to speed bumps would be cut into the roads in certain areas as needed to allow for natural drainage of water over the road surface and to prevent road washout. During grading activities, excavated soil and rock would be spread across the site to the natural grade and would be reseeded with native grasses to control erosion by water and wind. Larger excavated rocks would be disposed of offsite or crushed and reused onsite as backfill or roadway material.

During wind turbine installation, temporary staging areas and laydown areas would be required. These areas would be used for parking construction vehicles, construction employee’s personal vehicles and other construction equipment.

Flat areas adjacent to each turbine location, approximately 30 feet by 60 feet

(1,800 square feet) would be cleared, compacted and laid with gravel necessary to place turbine blades and other turbine components and to station a construction crane as each tower is erected. At the end of most turbine strings, an area approximately 900 feet by 24 feet (21,600 square feet or 0.5 acres) also would be needed to allow construction equipment to turn around. After construction has been completed, laydown and staging areas would be graded and reseeded to restore the area as close as possible to its original condition.

Foundations

The Project would require several foundations including bases for each turbine and pad transformer, substations equipment, and the O&M facility. Once the roads are complete for a particular row of turbines, turbine foundation construction would commence on that completed road section. Foundation construction occurs in several stages including drilling, blasting and hole excavation, outer form setting, rebar and bolt cages assembly, casting and finishing concrete, removing the forms, backfilling and compacting, constructing the pad transformer foundations and foundation site restoration.

Foundations for the turbine towers would most likely be a spread footing type foundation design. Typical dimensions for spread footing-type foundation design are shown in

Table 2.3-7. The spread footing would require holes approximately 100 feet by 100 square and about 18 feet deep. Backfill would be compacted in the bottom of the hole and reinforced square concrete footing would be poured. A reinforced concrete pedestal approximately 10 feet high would be mounted on the concrete footing to hold the tower. The concrete footing would be covered with approximately 6 to 8 feet of compacted backfill and four to six inches of topsoil depending on soil conditions. Figure 2.3-16 is a photograph of a spread-footing type foundation.

Table 2.3-7 Typical Spread-Footing Type Foundation Dimensions For A 1.5 MW Turbine

Foundation Base Line	60 x 60 feet
Pad Depth	8 feet
Pedestal Height	10 feet
Overall Depth	18 feet
Hole Dimensions	100 x 100 feet
Hole Depth	18 feet

The construction process for the foundations would vary depending on the foundation engineer’s requirements and soil conditions found at the site. The construction process may have variances from site to site if soil conditions are different; however it generally follows the same main steps as follows:

- Clearing and grubbing the area with a bulldozer at the exact surveyed turbine location
- Initial excavation of the foundation hole with a track hoe
- Drilling and setting charges and blasting out excavation area center and perimeter
- Loosen rock with hydraulic jack hammer
- Full excavation of foundation hole with the track hoe

- Installation and setting of the outer forms and pour concrete base mat (3-4 inches thick)
- Construct reinforcement bar (rebar) mat and pedestal anchor bolt cage
- Assemble forms in place for pedestal, Pour concrete, allow to set, remove forms
- Set outer form for tower floor pad and electrical conduits and pour concrete into place for floor
- Dispose of remaining soils
- Restore temporarily disturbed surfaces

Excavation and foundation construction would be conducted in a manner that would minimize the size and duration of excavated areas required for foundation installation. Portions of the work may require over excavation and/or shoring. Foundation work for a given site would commence after excavation of the area is complete. Backfill for the foundation would be installed immediately after approval by the engineer's field inspectors. Wind Hunter plans to use on-site excavated material materials for backfill to the extent possible. The excess excavated material not used as backfill for the foundation would be used to level out low spots on the crane pads and roads consistent with surrounding grade. The topsoil layer of the excavated materials would be reseeded with a designated mix of grasses and/or seeds around the edges of the disturbed areas.

Electrical Collection System

Once the roads, turbine foundations and transformer pads are complete for a particular row of turbines, underground cables would be installed on that completed road section. First a trench would be cut typically 3 to 4 feet deep depending on the underlying soil conditions and up to 5 feet wide. Clean fill would be placed above and below the cables for the first several inches of fill to prevent cable pinching. Once the clean fill covers the cables, the excavated material would be used to complete backfilling (Figure 2.3-11).

The high voltage underground cables would be fed through trenches and into conduits at the pad transformers at each turbine. The cables would run to the pad transformers' high voltage (34.5kV) compartment and would connect to the terminals. Low voltage cables would be fed through another set of underground conduits from the pad transformer to the bus cabinet inside the base of the wind turbine tower. The low voltage cable would be terminated at each end and the whole system would be inspected and tested prior to operation.

Transporting and Assembling Wind Towers

The wind turbines would have three main components: towers; nacelles; and rotor blades. Other smaller components include hubs, nose cones, cabling, control panels and internal tower facilities such as lighting and ladders. Turbine components would be delivered to the project site on flatbed transport trucks and main components would be off-loaded at individual turbine sites. Turbine erection would be performed in multiple stages including: setting the bus cabinet and ground control panels in the foundation, erecting the tower (usually in three to four sections; Figure 2.3-6), erecting the nacelle (Figure 2.3-7), assembling and erecting the rotor (Figure 2.3-8), connecting and terminating internal cables and inspecting and testing the electrical system prior to operation.

Turbine assembly and erection involves mainly the use of large truck or track mounted cranes, smaller rough terrain cranes, boom trucks, rough terrain fork lifts for loading and off loading materials and equipment, flat bed and low-boy trucks for transporting materials to the site.

Plant Commissioning and Energizing

Plant commissioning and energizing would occur after construction is completed and would not require the use of heavy machinery.

Erosion Control and Restoration

A construction Storm Water Pollution Prevention Plan (SWPPP) would be developed for the project to help minimize the potential for discharge of pollutants from the site during construction. The SWPPP would be designed to meet the requirements of the Montana Department of Environmental Quality's General Permit to Discharge Storm Water through its storm water pollution control program (Montana Water Quality Act 75-5-401 et seq., MCA) associated with construction activities. The SWPPP would include both structural and non-structural BMPs. Examples of structural BMPs could include installing silt curtains or other physical controls to divert flows from exposed soils, or otherwise limit runoff and pollutants from exposed areas of the site. Examples of non-structural BMPs include management practices such as materials handling and disposal requirements and spill prevention methods. Wind Hunter would prepare and submit a SWPPP meeting the conditions of the General Permit to Discharge Storm Water to the Montana Department of Environmental Quality along with a Notice of Intent (NOI) for construction activities prior to the start of project construction.

After construction is completed, site restoration activities would consist of restoring temporarily disturbed areas as close as possible to their original condition. This excludes the service roads, which would remain in place for the life of the project. For example, after backfilling excavated areas disturbed to construct underground electrical cables, excess excavated soils would be spread around the surrounding areas and contoured to natural grade. The areas affected by construction would be seeded with an appropriate seed mix where there is adequate soil moisture, as appropriate to the location, and would be re-seeded if healthy cover vegetation does grow. Similar restoration activities would be followed at areas temporarily disturbed for construction staging, equipment laydown and temporary construction access. On site construction management would monitor the area for erosion and implement additional control measures if necessary.

Since project cleanup generally consists of landscaping and earthwork, it is weather and season sensitive. Landscaping cleanup is generally completed during the first allowable and suitable weather conditions after heavy construction activities have been completed. As described above disturbed areas outside of the graveled areas would be reseeded to control erosion by water and wind. Construction cleanup and permanent erosion-control measures would be carried out in accordance with the project SWPPP.

Schedule and Workforce

Project construction of the Phase I would occur over a 6-month period from the time of receiving permit authorizations. Presently the project is slated to begin in Spring 2006 with project construction to be completed in Fall 2006. Each future phase would be constructed during a six to seven month period. Phase II construction would occur in 2009, Phase II construction in 2012 and Phase IV in 2016. It is estimated that construction of Phase I involving approximately 33 wind turbines would require a construction labor force of 84 workers. The labor force mix would include project management, field technical staff, skilled labor and equipment operators and unskilled labor. Table 2.3-8 shows the construction labor force mixfor Phase I based on a labor force of approximately 84 workers. Tables 2.3-9, 2.3-10 and 2.3-11 show the approximate construction labor force requirements for phases II, III and IV of the wind far, respectively.

Table 2.3-8 Phase I- 50MW- Construction Labor Force Mix-Wind Farm Approximate Number of Personnel)

Construction Phase	Project Management and Engineers	Field Technical Staff	Skilled Labor and Equipment Operators	Unskilled Labor	Total
Engineering/surveying/design	2	2	0	0	4
Road Construction	2	2	5	3	12
Foundation Construction	2	2	5	7	16
Electrical Collection System	2	2	5	3	12
Substation	3	2	5	4	14
Wind Turbine Assembly and Erection	2	2	6	4	14
Commissioning and Energizing the Plant	2	2	2	0	6
Construction Cleanup	1	1	1	3	6
Total	16	15	29	24	84

Table 2.3-9 Phase II- 100 MW- Construction Labor Force Mix Approximate Number of Personnel)

Construction Phase	Project Management and Engineers	Field Technical Staff	Skilled Labor and Equipment Operators	Unskilled Labor	Total
Engineering/surveying/design	3	7	0	0	10
Road Construction	3	3	8	3	17
Foundation Construction	2	2	12	17	33
Electrical Collection System	2	2	12	7	23
Substation	3	2	5	4	14
Wind Turbine Assembly and Erection	3	4	9	9	25
Commissioning and Energizing the Plant	3	5	9	0	17
Construction Cleanup	1	1	2	4	8
Total	20	26	57	44	147

Table 2.3-10 Phase III- 150MW- Construction Labor Force Mix (Approximate Number of Personnel)

Construction Phase	Project Management and Engineers	Field Technical Staff	Skilled Labor and Equipment Operators	Unskilled Labor	Total
Engineering/surveying/design	6	12	0	0	18
Road Construction	5	5	15	5	30
Foundation Construction	3	4	23	30	60
Electrical Collection System	2	3	23	12	40
Substation	5	3	8	4	20
Wind Turbine Assembly and Erection	4	6	15	15	40
Commissioning and Energizing the Plant	5	10	15	0	30
Construction Cleanup	1	1	3	10	15
Total	31	44	102	76	253

Table 2.3-11 Phase IV- 200 MW- Construction Labor Force Mix (Approximate Number of Personnel)

Construction Phase	Project Management and Engineers	Field Technical Staff	Skilled Labor and Equipment Operators	Unskilled Labor	Total
Engineering/surveying/design	6	12	0	0	18
Road Construction	5	6	15	8	34
Foundation Construction	3	5	24	30	62
Electrical Collection System	2	4	24	12	42
Substation	5	4	8	4	21
Wind Turbine Assembly and Erection	4	8	20	18	50
Commissioning and Energizing the Plant	5	10	15	0	30
Construction Cleanup	1	1	3	10	15
Total	31	50	109	82	272

2.3.2.2 Transmission Interconnection Facilities

Sequence of Construction Activities

Wind Hunter would not initiate any construction or other surface disturbing activities on the public land portion of the ROW until after issuance of the BLM grant by the Authorized Officer. Such authorization would consist of a written Notice to Proceed (Form 2800-15). Wind Hunter would conduct all activities associated with the construction and operation of the ROW within the authorized limits of the ROW and in strict conformity with the POD. A copy of the complete ROW grant, including all stipulations and approved POD, would be made available on the ROW during construction.

The construction of the project would follow the sequence of: 1) centerline surveyed and staked; 2) access roads built; 3) work areas cleared as needed; 4) foundations installed, towers erected and installed; 5) fiber optic or traditional ground wire, conductors, and ground rods installed, and 6) the site would be cleaned-up and reclaimed. The number of workers and types of equipment required to construct the project are shown in Table 2.3-12. Various phases of construction would occur at different locations throughout the construction process. This would likely require several crews operating at the same time at different locations. See Figure 2.3-17 for typical transmission line construction activities and Figure 2.3-18 for typical conductor tensioning and pulling activities.

Table 2.3-12 230kV Transmission Line Construction – Estimated Personnel and Equipment

Activity	People	Quantity of Equipment	
Survey	3	1	pickup truck
Road Construction	3	2	1Bulldozers (D-8 Cat), 1 Excavator
		1	road graders
		1	pickup trucks
		1	water/gas trucks
Excavation	4-6	2	Line bed with auger equipment
		2	pickup trucks
Structure Framing and Assembly Per crew - 1 crews total	4-6	1	pickup trucks
		1	carry all
		1	Crane (rubber tired)
		1	trucks (2 ton)
		1	Pole trailer
Structure Erection Per crew - 1 crews total	6-8	1	crane (rubber tired)
		1	trucks (2 ton)
		2	pickup trucks
		1	carry all
Conductor Installation and Stringing	10-15	1	wire reel trailers
		2	diesel tractors
		2	cranes (19-Ton, 30-Ton)
		1	trucks (5 ton)
		2	pickup trucks
		1	splicing trucks
		1	Single Drum Puller (large)
		1	3 drum puller
		1	Double bull-wheel tensioner
		1	sagging equipment (D-8 Cat)
		1	static wire reel trailer
		1	water trucks

Activity	People	Quantity of Equipment	
Clean-Up	4	1	Trucks
		1	pickup trucks
		1	Skid steer loader
		1	(D-6 Cat)
Road Rehabilitation (ROW restoration)	2	1	motor graders
		1	ATV
		1	Seed spreader
		1	pickup trucks
Maximum total personnel required for all tasks – 36-47 (actual personnel at any one time would be less)			

Surveying

Construction survey work for the proposed Project consists of determining centerline location, specific pole locations, ROW boundaries, work area boundaries and access roads to work areas. The preliminary locations of the centerline, structures, work areas and areas where access roads are not possible have been identified. Final design plans would be submitted with the final POD.

Access Road Construction

Transmission line construction, maintenance and operation require the movement of large vehicles along the ROW. When new access roads would be required, they would be constructed to support the weight of these vehicles. Existing roads would be used when the ROW closely parallels a utility corridor, or where other existing roads provide adequate access to the line. Where existing roads can be used, only spur roads to the tower sites would be required. Main and spur access roads would be constructed on the ROW where there are few or no existing roads.

When adverse conditions exist, such as the need to avoid sensitive resources, difficult topography or landowner requirements, the access roads sometimes are located outside of the ROW. Equipment to construct the access roads would include hand tools, bulldozers, graders and crew haul vehicles. Specific actions would be implemented to reduce construction impacts. Standard design techniques such as installing water bars and dips to control erosion would be included. In addition measures would be taken to minimize impacts in specific locations and during certain periods on the year. Such conditions could arise during heavy rains or high winds. To prevent impacts during such periods, construction activities would be restricted or curtailed.

Structure Sites Clearing

At each structure site, leveled areas (pads) would be needed to facilitate the safe operation of equipment, such as construction cranes. The leveled area required for the location and safe operation of large cranes would be approximately 30 by 40 feet. At each structure site, a temporary work area approximately 50 feet by 75 feet would be required for the location of tower footings, assembly of the tower, and the necessary crane maneuvers. The temporary work area would be cleared of vegetation only to the extent necessary. The permanent land area required for each structure base is 100 square feet. After line construction, all pads not needed for normal transmission line maintenance would be graded to blend as near as possible with the natural contours, and would be revegetated where required.

Pulling and Tensioning Site Clearing

Sites would be located at approximately two to three mile intervals along the assumed centerline of the project. The leveled area required for the location and safe operation of stringing and tensioning equipment would be approximately 100 feet x 300 feet. As with structure sites, the work area would be cleared of vegetation only to the extent necessary. After line construction, areas would be graded to blend as nearly as possible with the natural contours, and would be re-vegetated where required.

Foundation Installation

In general, wood pole structures would be set directly into holes augered in the ground and backfilled. Excess excavation material would be spread evenly around or adjacent to the site.

Structure Assembly and Erection

On wood pole lines, poles, “X” braces, cross arms, insulators and hardware would be delivered to the structure sites followed by framing crews to assemble structures at individual structure sites. Auger crews and equipment would be followed by erection equipment and backfill crews.

Conductor Installation

Large reels of conductor and overhead ground-wire would be delivered to preselected sites at two to three mile intervals. The conductor pulling, sagging and clipping operations would take place in rapid succession (Figure 2.3-18). A pilot line would be pulled (strung) from structure to structure and threaded through the stringing sheaves on each structure. A larger diameter, stronger line would then be attached to the pilot line and strung. This called pulling the line. This process is repeated until the ground wire and conductor is pulled through all sheaves. The pulling cables are used to pull the conductor through the structures under tension for the entire length between the preselected cable delivery sites. Therefore, the heavy pulling and tension equipment would not be set up at any intermediate locations. Approximately 10,000 to 16,000 feet of conductor would be installed for each pull, and two or three pulls could be completed each week.

Figure 2.3-18 Typical transmission Line Construction Activities

Figure 2.3-19 Typical Tensioning and Pulling Activities

Construction Waste Disposal

Construction sites, material storage yards, and access roads would be kept in an orderly condition throughout the construction period. Refuse and trash would be removed from the sites and disposed in an approved manner. Oils and fuels would not be dumped along the line. Oils or chemicals would be hauled to an approved site for disposal. No open burning of construction trash would occur without BLM, or private landowner approval.

Site Reclamation

The ROW would be restored as required by the BLM, or property owner. Every effort would be made to restore the land to its original contour and to restore natural drainage along the right-of-way as required. The reclamation would involve the personnel and equipment as shown in Table 2.3-12.

Work sites would be restored using excess materials, vegetation, and topsoil that has been stockpiled for that purpose. Excess soil materials, rock, and other objectionable materials that cannot be used in restoration work would be disposed of by the contractor.

If in the future Wind Hunter no longer desired a permanent road for patrolling and maintenance, access roads would be abandoned, revegetated, and stabilized by erosion control methods where necessary. Disturbed areas would be restored, as nearly as possible, to their original contour and reseeded where appropriate.

Fire Protection

A fire plan would be prepared. It would document all applicable fire laws and regulations to be observed during the construction period. All personnel would be advised of their responsibilities under the applicable fire laws and regulations.

2.3.2.3 Antelope Creek Substation

Construction

Initial substation construction would include grubbing vegetation from the site, followed by grading to transform existing gentle slopes into a sloping pad and access roadways. In addition, grading would provide for adequate drainage from the site and erosion control. It is assumed that little cut and fill would be required to accommodate substation development at either the collector substation or the interconnection substation. Grading would include a balance of cut and fill on the site. Blasting may be required if rock is encountered in the grading operations. Prior to placing any fill material, the area would be prepared per recommendations of geotechnical investigations. Work would include removing and recompacting any loose soil.

Some importing of suitable granular material would be needed for bedding of any underground facilities or features of the facility. The grading plan may require installation of drainage ditches outside the fenced area to redirect runoff from the site. Culverts may also be needed to direct the flow to match the natural drainage patterns.

Topsoil and organic material removed during grading that cannot be placed on the disturbed areas would be distributed evenly and restored, or exported. Upon completion of substation site grading, the entire surface pad area of the substation would be covered to an approximate six inches of crushed rock surfacing.

Equipment required for substation construction could include rippers, scrapers, rock drills, loaders and trucks to excavate, move and compact the material, as well as to form gently sloped equipment pads. Following site grading and development, reinforced concrete foundations would be installed to support the electrical equipment and requisite control facilities. Subsequent to the foundation installation, trenches would be dug to facilitate placement of copper conductors for the station-grounding mat. Placement of the grounding mat is followed by below-grade installation of electrical conduit and cable raceways to accommodate wiring for equipment power and control purposes.

The above-grade construction would involve installation of galvanized steel structures to support the incoming transmission line and high-voltage bus work consisting of aluminum jumpers and tubing. Other above-grade activities would include installation of porcelain insulators, circuit breakers, disconnect switches, coupling capacitor voltage transformers, power circuit breakers and power transformers.

Installing the foundations would require backhoes, drill rigs, concrete trucks and flatbeds to transport reinforcing steel and concrete to the site. The power transformers, due to their weight, would require specialized, heavy-hauler tractors to transport the units to required positions. Installing all other substation equipment would require the use of cranes, man lifts, portable welding units, line trucks, oil transports and a variety of crew vehicles.

The active construction schedule at the substation would occur for approximately 4-6 months, from the start of the site work to installation of the final electrical equipment. A longer time frame may be required to accommodate site revegetation or delays due to inclement weather. Subsequent work would require approximately testing and equipment checkout to ready the station for commercial operation. During excavation, water trucks may be used as required in all work areas to control dust in accordance with state and local regulations.

2.3.3 Operations and Maintenance

2.3.3.1 Wind Farm

The amount of downtime from scheduled maintenance is predictable from year to year. A typical operating plan includes a planned outage schedule that consists of wind turbine inspections and maintenance after the first three months of operation, a break-in diagnostic inspection (includes inspection of oil and all other elements of the wind turbine generator) and subsequent services every six months. The six-month servicing generally takes a wind turbine off-line for one day. The six-month routine consists of inspecting and testing safety systems; inspecting wear and tear on components such as seals, bearings and bushings; lubricating the mechanical systems; performing electronic diagnostics on the control systems; verifying pre-tension of the mechanical fasteners; and inspecting the overall structural components of the wind turbines. Blades would be inspected and if heavily soiled, rinsed once per year to maintain overall aerodynamic efficiency.

Electrical equipment such as breakers, relays and transformers requires weekly visual inspections, which does not affect overall availability, and testing or calibrations every one to three years, which may force outages. To the extent practical, the short-term off-line routine maintenance procedures would be coordinated with periods of little or no wind to minimize the impact on the amount of overall energy generation.

Unscheduled Maintenance and Forced Outages

Historically, modern wind power projects operate with availabilities in the 95 to 95% range. Several components and systems of an individual wind turbine can be responsible for forced non-routine outages such as malfunction of mechanical and electrical components, or computer controls. It is anticipated that most of the outages would result from auxiliaries and controls, not malfunction or failure of the heavy rotating machinery. Most machinery failures are found during routine inspections, with the failing part being replaced before complete failure.

Although the newer control systems have added a high level of detection and diagnostic capability, they normally require frequent adjustments in the first few months of operation. As a result, available energy from wind power projects is generally lower in the first few months until the turbines are fully tuned. Once a wind plant is properly tuned, unplanned outages are rare and downtime is limited to the routine service schedule.

The O&M facility would be stocked with sufficient spare parts to support high levels of availability during operation. The modular design of modern wind turbines allows most of the parts to be quickly changed, especially in the electrical and control systems. This modularity and the fact that the turbines would be identical means components could be swapped between turbines to quickly determine causes of failures even if the correct spare part is not in stock. As part of their supply agreements, almost all major turbine equipment vendors guarantee the availability of spare parts for 20 years.

General project operations would require between 12 and 20 onsite staff consisting of a plant/site manager, operations manager, administration manager and operating technicians. The number of onsite personnel is not only determined by the number of turbines but also the type of turbine selected since some turbines require more man-hours of maintenance per year than others. It is estimated that approximately one half of the full-time staff would be hired locally.

Site Security

The plant operations group would prepare a detailed security plan to protect the project and project personnel. Site visitors including vendor equipment personnel, maintenance contractors, material suppliers, and all other third parties would require permission for access from authorized project staff at the O&M facility prior to entrance to secured project area such as the turbines and substations. The plant operations manager, or designee, would grant access to critical area of the site on an as-needed basis.

Arrangements would be made with adjacent landowners that have legal ingress and egress across areas where project facilities would be located to ensure continued access to their property.

Access to the main O&M facility area, site trailers and all wind turbine string roads would be constructed with lockable gates. The access would be open during working hours and would be secured by project personnel after working hours.

Both the O&M facility and the substation would be equipped with outdoor lighting and motion sensor lighting. An 8-foot-tall chain link fence would surround the substation with razor wire along the top. Wind turbines, pad transformers, pad-mounted switch panels and other outdoor facilities would have secure lockable doors.

An Emergency Response Plan would be established for the project to ensure employee safety for emergencies such as personnel injury, fires, explosions and other scenarios where evacuation would be required. The Emergency Response Plan would cover project employees, site visitors, and on-site contractors and would be administered by the project operations manager or designee.

2.3.3.2 Transmission Interconnection Facilities

Operational Characteristics

The nominal voltage for the proposed 230kV transmission line would be 230kV alternating current (AC). The line would be energized initially at 161kV to match the voltage of Western's transmission system. There could be minor variations of up to five percent above the nominal level depending upon load flow.

Operational Procedures

The day-to-day operation of the line is directed by system dispatchers in power control centers. These dispatchers utilize Western's facilities to operate circuit breakers at each end of the line. The circuit breakers also operate automatically to further insure safe operation of the transmission line.

Use of the Right of Way

When the transmission line has been energized, land uses that are compatible with safety regulations might be permitted in and adjacent to the ROW. Existing land uses such as agriculture and grazing generally are allowed within transmission line ROWs. Incompatible land uses within transmission line ROWs include construction and maintenance of inhabited dwellings, and any use requiring changes in surface elevation that would affect existing or planned facilities.

Land uses that comply with local regulations would be permitted adjacent to the ROW. Compatible uses of the ROW on public lands would have to be approved by the BLM. The ROW through private lands could be used for roads, agriculture crops and other purposes consistent with the easements.

Safety

Safety is a primary concern in the design of this 230kV transmission system. An AC transmission line would be protected with power circuit breakers and related line relay protection equipment. If conductor failure were to occur, power would be automatically removed from the line. Lightning protection would be provided by overhead ground wires along the line. Electrical equipment and fencing at the substation would be grounded.

Maintenance

The 230kV transmission line would be inspected on a regular basis by both ground and air patrols. Maintenance would be performed as needed. When access would be required for non-emergency maintenance and repairs, the maintenance crews would adhere to the same precautions that would have been taken during the original construction.

Transmission lines damaged by storms, floods or accidents require immediate repair. Emergency maintenance would involve prompt movement of repair crews to repair or replace any damage. Crews would be instructed to protect crops, plants, wildlife, and other resources of significance. Restoration procedures following completion of repair work would be similar to those prescribed for normal construction. The comfort and safety of local residents would be a primary concern during construction and maintenance activities.

2.3.3.3 Antelope Creek Substation

Operations and Maintenance

Substation monitoring and control functions would be performed remotely from Western's operations facilities. Unauthorized entry into substations is prevented with the

provision of fencing and locked gates. At Antelope Creek Substation, a remotely monitored security system may be installed, if warranted. Warning signs would be posted and entry to the operating substation would be restricted to Western authorized personnel.

Maintenance activities include equipment testing, equipment monitoring and repair and emergency and routine procedures for service continuity and preventive maintenance. Routine operations would require visits to the substations on a weekly basis. Approximately once per year a major maintenance inspection would take place. Safety lighting at the substations may be provided inside the substation fence for the purpose of emergency repair work.

2.3.4 Decommissioning and Abandonment

The design life of major project equipment such as the turbines, transformers, substations and supporting plant infrastructure is at least 20 years. The trend in the wind energy industry has been to repower older wind projects by upgrading older equipment with more efficient turbines. It is likely that after mechanical wear takes its toll, the project could be upgraded with more efficient equipment and could have a useful life longer than 20 years.

At the end of the useful life of the proposed project, if the facility were no longer required, the transmission line would be abandoned under the terms of the ROW agreement with BLM, and other easement agreements. Subsequently, structures, conductors, insulators and hardware would be dismantled and removed from the ROW. Wood pole structures would be cut off below the ground surface or removed entirely. Following abandonment and removal of the transmission line from the right-of-way, areas leveled for equipment required to dismantle the line would be restored as near as possible to their original condition.

2.4 ALTERNATIVES TO THE PROPOSED ACTION

2.4.1 No Action Alternative

Under the No Action Alternative, the VCWEP would not be constructed or operated and the environmental impacts and benefits described in this environmental document would not occur. The No Action Alternative assumes that existing land uses and farming, ranching and rural lifestyles would remain unchanged. However if the proposed project is not constructed, it is likely that the region’s need for power would be addressed by a combination of user-end energy efficiency and conservation measures, existing power generation sources, or by the development of new renewable and non-renewable generation sources. Base load demand would likely be filled through expansion of existing or development of new thermal generation such as a gas-fire combustion turbine generation facility or coal fired generation facility.

Because the project at full build out would have a nameplate capacity of approximately 500 MW and is expected to have a 33% net capacity factor, a natural gas-fired combined cycle combustion turbine would have to generate 413 MW at a 39.9 percent capacity factor average MW of energy to replace an equivalent amount of power generated by the project. A coal fired generation facility would have to generate an average of 233 MW at a capacity factor of a 70.6 to replace the equivalent amount of energy generated by the project (NEI 2004). An average MW or “aMW” is the average amount of energy supplied over a specified period of time, in contrast to “MW” which indicates the maximum or peak output (capacity) that can be supplied for a short period.

Impacts from gas fired or coal fired combustion turbine projects include air emissions and other impacts of construction and operation near the new plant. Combustion turbine projects require significant amounts of water, the extraction of which may have adverse impacts on surface water and groundwater resources.

2.4.2 Alternatives Considered and Eliminated

During the project development and planning, Wind Hunter considered alternative wind turbine technologies, alternative wind turbine locations and alternative project layout. The alternatives considered and eliminated are described below.

2.4.2.1 Alternative Wind Energy Technologies

Several types of wind energy conversion technologies have been pursued over the past 30 years. Figure 2.4-1 and Table 2.4-1 compares various turbine technologies on the basis of the relative scale of commercially used wind turbine units and their typical sizes. Although larger scale versions of these models have been produced, the diagram illustrates the average size of versions that have been implemented on a large scale.

Table 2.4-1 Comparison of Various Wind Turbines

Technology Type	Typical Generator Size	Typical Size	Approximate Number of Units Required for 300 MW	Typical Rotation Speed
(A) Darrieus rotor	50-100kw	100-150 feet	3,975	50-70 RPM
(B) Two bladed (downwind)	50-200kw	150-200 feet	3,975	60-90 RPM
(C) Three bladed (upwind)	500-750kw	240-300 feet	480	28-30 RPM
(D) Three bladed upwind –Proposed Project	1,500 kw (1.5 MW)	300-400 feet	200	10-23 RPM

The proposed action contemplates the use of megawatt-class wind turbines, identified in Figure 2.4-1 and Table 2.4-1 as technology "D". Compared to the other three technologies illustrated, this type of turbine requires fewer machines, covers a smaller overall project footprint, and is anticipated to have fewer avian impacts because of a smaller Rotor Swept Area (RSA) and lower RPM. A discussion of other available wind energy technologies and the reason for their rejection is presented below. The choice of the three bladed, upwind, horizontal axis wind turbine (HAWT) technology meets Wind Hunter's need for producing power cost effectively, maximizing equipment reliability, producing power at a commercially viable utility scale, maximizing power conversion efficiency, minimizing turbine footprint and associated ground disturbance and minimizing avian impacts.

Vertical Axis Darrieus Wind Turbines (Technology "A")

French Engineer D.G.M. Darrieus invented the most widely used vertical axis wind turbine (VAWT) in the 1920s. It is called the Darrieus wind turbine, Darrieus rotor, and is commonly referred to as the "eggbeater" (Figure 2.4-1)

The Darrieus turbine was experimented with and used a number of wind power projects in the 1970s and 1980s including projects in California; an experimental machine installed by FloWind on Thorp Prairie located in Kittitas County, Washington. Despite years of design, experimentation, and application, the Darrieus turbine never reached full commercial-scale maturity and success to the level that the horizontal axis turbines have for a number of reasons including inherent design and operation disadvantages, as discussed below.

Higher Wind Speeds Higher Above the Ground

Darrieus rotors are designed with much more of their swept area close to the ground compared to HAWTs. As the wind speed increases with the height above ground HAWTs benefit from having higher wind speeds and higher energy incident to their rotor plane than can be extracted.

Start-up Wind Speed

VAWTs require a higher level of wind energy to actually start spinning compared to HAWTs. In older VAWT machines, the generator was used as a motor to start up the rotors. Modern VAWTs do not require a generator to start up the rotor. HAWTs require less wind speed for start-up and most have the advantage of variable pitch blades, which allow the turbine to start up by a simply change to the blade pitch.

Variable Pitch

VAWTs do not have variable pitch capability and rely on stall regulation, which results in less efficient energy capture. Most modern HAWTs have mechanisms that pitch blades along their axis to change the blade angle to catch the wind. Variable pitch allows the turbine to maximize and control power output.

Bird Crash Hazards - Guy Wires

VAWTs are constructed with guy wires that add to the overall disturbed airspace area. Guy wires have been shown to be a greater hazard to bird than turbines themselves because they are difficult for birds to see. HAWTs are typically erected on freestanding tubular steel towers and do not require the use of guy wires.

Turbine Footprint

VAWTs are fitted with four sets of guy wires that span from the top of the central tower and are anchored in foundations. Including the tower base foundation, VAWTS require a total of five foundations all spread apart. The result is that the overall footprint and disturbed area for a VAWT is larger than that for a comparably sized HAWT. HAWTs on freestanding towers use only one main foundation and have a smaller overall footprint.

Fatigue Life Cycles

Because of their design, VAWTs have higher fatigue life cycles than HAWTs, resulting in earlier and more frequent mechanical failures. As the VAWT rotor blades rotate through one full revolution, they pass upwind, downwind and through two neutral zones (directly upwind and directly downwind of the tower). In contrast the rotor blades on a HAWT do not pass through similar upwind/downwind neutral zones and the fatigue life cycles are lower.

Figure 2.4-1 Comparison of Various Wind Turbine Technologies

Because this alternative could not meet the stated purpose and need for the Project to be safe, environmentally sound, and economically viable, this alternative was considered and rejected as a reasonable alternative.

Two-Bladed Downwind Wind Turbines (Technology “B”)

The most widely used vertical two-bladed wind turbines are of the downwind variety and in the size range of 50 to 200kW. They are referred to as downwind since the blades are downwind of the supporting tower structure. Although there is continued experimentation with prototype wind turbines of the design of a larger scale (300-500kW) they are not as well proven as the three-bladed upwind technology.

The two-bladed turbines require a higher rotational speed to reach optimal aerodynamic efficiency compared to a three-bladed turbine. Because this alternative could not meet the stated purpose and need for the Project to be safe, environmentally sound, and economically viable, this alternative was considered and rejected as a reasonable alternative.

Smaller Three-Bladed Upwind Wind Turbines (Technology “C”)

Over the past 20 to 30 years, wind turbines have become larger and more efficient. For comparison purposes a smaller 660kW turbine is about 73% the height of a 1500kW (1.5 MW), while its output is only 44% that of the 1.5 MW turbine. Compared to the proposed action, using smaller turbines in the 500 to 750kW range would be less cost-effective and would require more than twice as many total turbines for an equivalent energy output. This would result in more turbine foundations, larger project footprint and an overall higher impact on the surrounding environment.

Compared to the proposed project, use of such smaller turbines would also result in a greater RSA (rotor sweep area) to produce the same amount of energy, and therefore a greater incidence of avian impacts. Because this alternative could not meet the stated purpose and need for the Project to be safe, environmentally sound, and economically viable, this alternative was considered and rejected as a reasonable alternative.

2.4.2.2 Alternative Wind Farm Locations

The siting of wind turbines is constrained by the need for a location with a sufficient wind resource to allow the project to operate in a commercially and technically viable manner. Therefore wind turbines must be sited in location where data show there are sufficient wind speeds on a regular basis throughout the year. Also, wind farms must be located within a reasonable distance of transmission that would allow delivery of power to customers on the interconnected transmission grid.

Cameron Point

Wind Hunter began searching in northeastern Montana for a robust wind regime in 1999. A wind regime was identified at that time at Cameron Point on the Fort Peck Indian Reservation (refer to Figure 2.4-2), where the developer had developed a relationship with certain tribal members. The wind resource was studied through installation of a meteorological tower and development and approval of an Environmental Assessment with the Bureau of Indian Affairs. A FONSI was signed in 1999 approving a 50 MW wind fThe EA did not specifically address the interconnection transmission requirements or the interconnection point on Western's Fort Peck to Havre 161kV transmission line. However, after the FONSI was signed the tribe rejected the wind proposal on Cameron Point. Because the tribe rejected this site and there was no reasonable prospect of the tribe approving this or other sites on the Fort Peck Indian Reservation, developing a site on the reservation in suitable wind regimes was considered and eliminated as a reasonable alternative.

Opheim Area

Following rejection of the proposal to construct a 50 MW wind farm at Cameron Point on the Fort Peck Indian Reservation (see discussion above), Wind Hunter in 2001 began investigations on adjacent private and public lands areas by examining the NREL Wind Speed mapping. The Opheim area shows considerable wind regimes on the high ridges and flat plateaus in the area (refer to Figure 2.4-2). However, the distance to the nearest transmission line, Western's Fort Peck to Havre 161kV transmission line, is over 50 miles, a distance too great to make the wind generation project economically viable.

Because a wind project in the Opheim area could not meet the stated purpose and need for the Project to be economically viable, this alternative was considered and rejected as a reasonable alternative.

Other Site Locations

Other possible project site locations in the region or the state of Montana could jeopardize or eliminate the Project's feasibility because of lack of sufficient wind resource (leading to operation problems and a lower return on investment), and/or remoteness to existing transmission lines with adequate outlet capacity. Although there are other areas in the State of Montana predicted to have a wind resource adequate for producing energy at competitive prices, Wind Hunter has not developed relationships with the local communities, agencies, or landowners in these areas, and does not currently have wind leases on private lands or have other marketing or transmission information needed to develop a feasible project in other locations.

Wind Hunter has rejected other wind sites in the vicinity of the proposed Project, and is competing with other wind sites and projects being considered in other parts of the state and nation. In addition, ground-based measurement would be necessary to confirm the wind resources in any other identified area, of which most would not be suitable for wind development because of site accessibility issues (e.g., construction issues), distance to transmission, and other economic factors. Because other wind sites in the area could not meet the stated purpose and need for the Project to be economically viable, the alternative of evaluating other wind sites in the region or state was considered and rejected as a reasonable alternative.

2.4.2.3 50 MW Project

A smaller project of 50 MW (i.e., first phase only) would not be an economically viable alternative, and Wind Hunter has rejected constructing a wind project of a size where

Figure 2.4-2 Alternative Wind Farm Locations and Wind Regimes in Vicinity of Proposed Project

economic feasibility is not possible. A 50 MW alternative would not meet the stated purpose and need for the Project to be economically viable. Because a wind project in the Opheim area could not meet the stated purpose and need for the Project to be economically feasible, this alternative was considered and rejected as a reasonable alternative.

2.4.2.4 Transmission Alternatives

Several transmission corridors were identified as possible routing alternatives for a 230kV transmission interconnection between Wind Hunter's proposed power source (50 MW wind development-first phase), to a new WAPA substation, known as Antelope Creek located just east of Northwestern Energy's Richardson Coulee Substation. The proposed 230kV transmission line would be energized initially at 161kV to match the voltage of Western Area Power Administration's (WAPA) transmission system. The alternatives were identified through a transmission line siting study conducted during June and July 2004. The study analyzed several alternatives and compared the potential impacts of each alternative. Reasoning for eliminating alternatives, as described below, are directly derived from the siting study.

Pipeline Corridor

This corridor would place the transmission line along an existing gas pipeline generally oriented in a southwesterly direction. The alternative would begin west of State Route 24 near the Glasgow Industrial Airport, and end near the community of Tampico (Figure 2.4-3). The corridor would cross through the Montana Fish, Wildlife & Parks Tampico Conservation Easement Wildlife Management Area. This conservation easement provides year round habitat for wildlife and public recreational opportunities such as hunting and wildlife viewing. Other issues associated with this corridor include the prevalent diagonal crossing of land parcels, irrigated and non-irrigated cropland, and cottonwood galleries associated with the Milk River. Fewer existing roads along this corridor also limit routing opportunities. Many single-family residences are located in close proximity to the corridor, resulting in considerable visual impact. Compatibility issues with the pipeline also exist (i.e., corrosion). For these reasons, this corridor was eliminated from detailed evaluation as a reasonable alternative.

Conservation Easement Corridor

This corridor is located between U.S. Highway 2 and Montana Secondary 246 (Figure 2.4-3). The corridor would cross through a large section of the Montana Fish, Wildlife & Parks Tampico Conservation Easement Wildlife Management Area. Utilization of this corridor would include the diagonal crossing of land parcels, irrigated and non-irrigated cropland, and cottonwood galleries associated with the Milk River. A single-family residence is located in close proximity to the corridor, resulting in considerable visual impact. For these reasons, this corridor was eliminated from detailed evaluation as a reasonable alternative.

U.S. Highway 2 Buggy Creek Segment Corridor

This corridor begins approximately 3 miles northeast of Vandalia where it proceeds in a southeasterly direction, parallel to U.S. Highway 2, for approximately 8 miles (Figure

2.4-3). The corridor does not offer a reasonable path to the proposed Antelope Creek Substation, since it travels east a number of miles and then doubles back west and southwest resulting in the potential for additional impacts because of the length. The corridor also crossed immediately adjacent to or through a Montana Department of Transportation Rest Area where it could result in visual and or physical impacts. For these reasons, this corridor was eliminated from detailed evaluation as a reasonable alternative.

Tampico Road Segment Corridor

This corridor begins approximately 1 mile northwest of Vandalia where it proceeds in a southeasterly direction, parallel to Tampico Road, for approximately 5½ miles. The corridor then turns south for approximately ½ mile until it ends near Antelope Creek Substation (Figure 2.4-3). The corridor would cross through the Montana Fish, Wildlife & Parks Tampico Conservation Easement Wildlife Management Area. The community of Tampico, as well as dispersed single-family residences located along Tampico Road, are located in close proximity to the corridor, resulting in considerable visual impact. For these reasons, this corridor was eliminated from detailed evaluation as a reasonable alternative.

Kirwin Road Corridor

This corridor begins near Tampico, where it proceeds in a southerly direction for approximately 4 miles, and ends approximately 1½ miles north of the Richardson Coulee Substation (Figure 2.4-3). The community of Tampico, as well as a single-family residence located along Kirwin Road approximately 2½ miles south of Tampico, would be located in close proximity to the corridor, and would result in near foreground visual impacts. Because of the severity of the visual impacts in these locations, this corridor was eliminated from detailed evaluation as a reasonable alternative.

Billingsley Cutoff Corridor

This corridor begins along Jensen Trail approximately ½ mile south of Riggin Road. The corridor proceeds in a southwesterly direction for approximately 3 miles, where it ends along Billingsley Road, approximately 4 miles east of the Richardson Coulee Substation (Figure 2.4-3). Utilization of this corridor would include the diagonal crossing of land parcels, irrigated and non-irrigated cropland, and cottonwood galleries associated with the Milk River. Fewer existing roads along this corridor also limit routing opportunities. Two single-family residences are located in close proximity to the corridor, resulting in considerable visual impact. Compatibility issues with the pipeline also exist (i.e., corrosion). For these reasons, this corridor was eliminated from detailed evaluation as a reasonable alternative.

2.4.2.5 Alternative Technologies

<u>Underground Construction</u>

Underground transmission systems in the United States have been built since the late 1920s. Usually, underground construction is used for lower voltage distribution lines in urban areas. High-voltage (115kV or above), short-distance, underground installations

Figure 2.4-3 Routes Considered But Eliminated

have been constructed where overhead lines were not feasible (e.g., in the vicinity of airports, urban centers).

High voltage underground transmission lines have markedly different technological requirements than lower voltage underground distribution lines. The majority of the cable would be installed using open-cut trenching techniques. The basic cost of undergrounding a high voltage transmission line can be up to ten to fifteen times more expensive than the cost of overhead construction. The relatively high cost and installation requirements prohibit the application of underground transmission systems for long distance electric transmission. Undergrounding high voltage transmission lines would typically only be done where required by law or where overhead construction would pose a threat or impedance to existing uses within an area.

While underground transmission lines are relatively immune to weather conditions, they are vulnerable to cable/splice failure, washouts, seismic events, and incidental excavation. Outages for underground lines generally last days or weeks while the problem is located, excavated, and repaired. Typically, failures in overhead lines can be located and repaired in a matter of hours. Long-term outages would be unacceptable, as they would potentially lead to blackouts to customers for long periods while the outage is repaired.

During construction, the environmental impacts of an underground transmission line would be similar to those for major pipeline construction. Greater adverse environmental impacts could be expected because the entire ROW would be disturbed. Particularly, underground construction crossing through wetland and riparian areas and crossing rivers would cause much more significant environmental impacts than an overhead transmission line.

The entire ROW would be disturbed, where as an overhead transmission ROW would only involve disturbance at each tower location or other work areas. Typically, no land uses, trees, or structures would be allowed within an underground ROW. Although limited, overhead transmission ROWs would typically allow trimmed trees and potentially some types of structures not directly under the line.

In undeveloped areas, the ROW would be cleared of all trees, brush, and ground cover in order to establish the alignment and to permit construction for an underground line. Overhead transmission line construction typically would result only in disturbances at individual tower sites and at the ancillary facilities associated with access to the ROW.

Magnetic field strength from electric transmission lines is related to the distance from line. While an underground line may reduce the strength of the field at a more rapid rate than an overhead line with distance from the line, the field directly above the underground line can be very high due to its proximity to the ground level.

An underground transmission line would be technically feasible and have few above ground structures and, therefore, less visual contrast than above ground transmission lines. However, because of the technical complications, economic and environmental costs and accessibility, an underground system was not considered a viable alternative and was eliminated from further consideration.

2.4.3 Action Alternatives Evaluated in Detail

2.4.3.1 Wind Farm Build-Out

Wind Farm Alternative A (150 MW) – Phases I and II

This alternative would be a smaller development than the Proposed Action of 500 MW. It would include development of the first two phases of the Project only, a 50 MW first phase and a 100 MW second phase (refer to the description of the Proposed Action in Section 2.3).

Wind Farm Alternative B (300 MW) – Phases I, II and III

This alternative would also be a smaller development than the Proposed Action of 500 MW. It would include development of the first three phases of the Project only, a 50 MW first phase, a 100 MW second phase, and a 150 MW third phase (refer to the description of the Proposed Action in Section 2.3). Alternative A and B and the four wind farm phases that make up the proposed action are shown on Figure 2.4-4.

2.4.3.1 Transmission Interconnection Route Alternatives

Based on the wind farm location and the interconnection point on the Fort Peck to Havre 161kV transmission line, the planning team prepared a regional siting study to determine reasonable alternative transmission line corridors and routes, described later in this section. The study was conducted in July and August of 2004. In this study, the physical and topographic constraints, major land uses, habitats, and other factors would be analyzed to define “reasonable” transmission line alternatives. Study area boundaries were first developed that would not be reasonably be crossed to make the transmission interconnection.

The west side of the study area was defined on the west side of Britsch Road because no reasonable alternative routes would cross farther west because of the additional miles of transmission line and associated impacts with a substantially longer line. The east side of the study areas was defined on the east side of Highway 24, beyond which the Fort Peck Indian Reservation becomes a prominent boundary. A transmission line could only be permitted through this reservation if approved by the Tribal Council. The northern boundary was defined on the north end of the wind farm. No reasonable transmission interconnection to the south would travel farther north. The southern boundary was defined south of the Milk River, Richardson Coulee Substation, and Billingsley Road, again with the rationale that no reasonable interconnection would travel farther south than these prominent east-west physical features.

Field observations were made by key members of the planning team to examine transmission interconnection corridors and routes, alternatives to the wind farm and transmission line, the site of the proposed wind farm and Antelope Creek Substation, nearby land uses, key habitat areas, potential visual impacts, and features or conditions

Figure 2.4-4 Wind Farm Phasing, Alternatives and Proposed Action

which may affect the environmental permitting process, design, construction, or right-of-way acquisition. Readily available, existing data from secondary sources (e.g., BLM, Valley County, Farm Service Agency, SHPO, Montana Natural Heritage Program, DNRC, DFWP) and other library sources such as published and unpublished reports was then collected and mapped.

The team also obtained existing transmission lines, canals, gas pipelines, and other linear features from local electric cooperatives and utilities. The team also conducted a high-level existing cultural sites literature review and records search of National Register sites present in the study area (the Class I inventory was completed later on the alternative routes). Information on the following resources was collected and mapped:

- Land Uses
- Visual Resources
- Cultural Resources / Native American Cultural Properties
- Major Geohazards
- Water Resources
- Biological Resources (Wildlife, Botanical, T&E)
- Visual Resource Sensitivity

Based on the information, data, and comments collected for the study area to this point, the planning team developed criteria to assist in determining how sensitive a resource would be to the proposed 230kV transmission interconnection line. Sensitivity is that measure of probable adverse response of each resource to direct and indirect impacts associated with the construction, operation, maintenance, and abandonment of the proposed transmission line. In this determination, the following criteria were considered:

- Resource Value: A measure of rarity, high intrinsic worth, singularity, or diversity of a resource within the area
- Protective Status: A measure of the formal concern expressed for a resource, either through legal protection or by designation of special status
- Present and Future Uses: A measure of the level of conflict based on policies of land management and/or use
- Hazards: A measure of the degree to which a resource represents a significant hazard to construction and/or operation of the proposed project

Using these criteria as a framework, the mapped corridor inventory data was categorized for relative sensitivity to the introduction of the proposed transmission interconnection. The team combined the individual resource sensitivity maps to produce a composite GIS map that illustrated constraints to and opportunities for routing the 230kV transmission lines within the study area. Areas or features highly sensitive to disturbance from the construction, operation, and maintenance of the transmission line represented the greatest potential constraints, or potentially significant changes to the natural, cultural, or human environment. The constraints were identified and mapped as:

- **Exclusion Areas:** Areas determined to be unsuitable because of unique, highly valued, complex, or legally protected resources; significant potential conflict with

existing or planned use; and areas posing substantial hazard to construction, operation, or maintenance of the line. These areas may also represent significant cumulative impacts from the interaction between resources. For purposes of the refinement of the assumed centerlines, these areas should be avoided.
- **Avoidance Areas:** Areas of potentially high impact because of important or valued resources; resources assigned special status; some conflict with existing or planned use; and areas posing some hazard to construction, operation, or maintenance of the line. For purposes of the refinement of the assumed centerlines, crossing of these areas should be minimized to the degree possible.
- **Low to Moderate Sensitivity:** Areas of minimal sensitivity generally indicate opportunities for siting the assumed centerlines. These opportunities occur where the impacts can be reduced, minimized, or spanned. In many cases, similar impacts have already occurred or will occur in the future. An example of such an opportunity would be an area of low sensitivity that has roads and existing or planned utility rights of way.

Areas or features that are highly sensitive to disturbance from construction, operation and maintenance of the transmission line represented the greatest constraints. Within the constraining features, the team identified corridors of varying width minimizing the crossing of highly constrained areas. Within these corridors, assumed centerlines for the various alternative routes were laid out, again minimizing the crossing of highly constrained areas and resources. Disturbance of these features could potentially result in significant changes to the natural, human or cultural environment. Areas exhibiting minimal sensitivity generally indicate opportunities for siting. These opportunities occur where impacts can be reduced or minimized. The corridors and assumed centerlines were sited to:

- Avoid and Minimize crossing of constraining resources (high sensitivity resources)
- Conform to agency constraints, other utility rights-of-way, permit stipulations and licensing requirements
- Minimize impacts to private landowners
- Maximize the use of existing access and minimize access road construction
- Minimize clearing requirements at the crossing of the Milk River, Buggy Creek, and other major riparian zones
- Optimize efficient and cost-effective design criteria
- Provide adequate space for angles and dead-end structures, as appropriate
- Maximize the use of natural and man-made terrain features
- Maximize opportunities to parallel linear features, as appropriate (e.g., existing roads, utility rights of way)

Several of the alternative routes were considered and eliminated from further consideration (refer to Section 2.4.2.4). The resulting network of alternative routes were analyzed, and impacts and mitigation measures (refer to Section 2.6) identified for each. Subroutes were identified for the purpose of comparing link segments for localized alternative routes that share common endpoints. These comparisons were necessary to determine the alternative route through these localized areas resulting in the least environmental impact. The impact data were then summarized for the links that made up each set of localized alternatives, or subroute sets. The localized alternatives, or subroutes, within each subroute set were then compared and the preferred subroute selected based on the least environmental impact. One subroute was selected as the preferred subroute or preferred localized alternative for this area. The localized routing alternatives with the least impacts were selected and joined with individual links where no localized routing preferences were required, to assemble the following five end-to-end alternative routes:

- Alternative A – Highway 24 Route
- Alternative B – Jensen Trail Route
- Alternative C – East Central - Proposed Action Route
- Alternative D – Britsch Road Route
- Alternative E – West-Central Route

Residual impact data for each subroute is summarized in Table 2.4-2. Residual impact data is also summarized for each alternative route in Table 2.4-3. The five alternative transmission line routes, and the links which comprise them, are illustrated in Figure 2.4-5.

Table 2.4-2 Subroute Residual Impact Summary

Subroute	Link #'s in Subroute	Residual Impact	Soils	Paleo	Land Use	Geohazard	Biological	Visual	Cultural	Water	Total
B1	19,20,22	H	0	0	0	0	0.2	4.5	0	0	4.7
		M	1.4	0	1.3	0	0.8	2.9	0	0.1	6.5
		L	7.5	5.5	7.6	3.6	3.1	1.5	3.8	0.5	33.1
		NI	0	3.4	0	5.3	4.8	0	5.1	8.3	26.9
B2	18,23,24	H	0	0	0	0	0.2	3	0	0	3.2
		M	0.8	0	1.9	0	0	5.4	0	0	8.1
		L	8.9	6	7.8	1	1.4	1.3	2.8	0	29.2
		NI	0	3.7	0	8.7	8.1	0	6.9	9.7	37.1
C1	22	H	0	0	0	0	0.2	4.5	0	0	4.7
		M	0.6	0	1.3	0	0.7	2	0	0	4.6
		L	5.9	3.1	5.2	2.1	1.6	0	2.2	0.4	20.5
		NI	0	0	0	0	0	0	0	0	0

Subroute	Link #'s in Subroute	Residual Impact	Soils	Paleo	Land Use	Geohazard	Biological	Visual	Cultural	Water	Total
C2	21,24	H	0	0	0	0	0.2	3	0	0	3.2
		M	0.9	0	1.9	0	0	5.4	0	0.1	8.3
		L	7.9	4.7	6.8	1.1	0.8	0.4	2.6	0	24.3
		NI	0	4.1	0.1	7.7	7.8	0	6.2	8.7	34.6
D1	2	H	0	0	0	0	0	4.2	0	0	4.2
		M	0	0	0	0	0	1.6	0	0	1.6
		L	7.8	7.7	7.8	0	7.2	2	3.9	0.9	37.3
		NI	0	0.1	0	7.8	0.6	0	3.9	6.9	19.3
D2	1,4,7	H	0	0	0	0	0	0.8	0	0	0.8
		M	3.2	0	0	0	7.9	5.9	0	1	18
		L	5.7	8.9	8.9	4.3	0.3	2.2	8.2	1.3	39.8
		NI	0	0	0	4.6	0.7	0	0.7	6.6	12.6
D3	16	H	0	0	0	0	0.4	0	0	0	0.4
		M	3.7	0	0	0	8.5	1.9	0	1	15.1
		L	8.4	11.5	12.1	7.6	2.4	10.2	10.9	1.4	64.5
		NI	0	0.6	0	4.5	0.8	0	1.2	9.7	16.8
D4	15,17	H	0	0	0	0	0.5	0.5	0	0	1
		M	1.5	0	1.6	0	5.5	5.4	0	0	14
		L	11	10.1	10.9	3.8	0	6.6	7.5	0.8	50.7
		NI	0	2.4	0	8.7	6.5	0	5	11.7	34.3
D5	2,9	H	0	0	0	0	0	15	0	0	15
		M	0	0	0	0	0	1.6	0	0	1.6
		L	18.6	18.5	18.6	0.1	18	2	14.1	1.7	91.6
		NI	0	0.1	0	18.5	0.6	0	4.5	16.9	40.6

Subroute	Link #'s in Subroute	Residual Impact	Soils	Paleo	Land Use	Geohazard	Biological	Visual	Cultural	Water	Total
D6	1,4,8,13	H	0	0	0	0	0	0.7	0	0	0.7
		M	7	0	0	0	16.7	7.2	0	1.7	32.6
		L	13.6	16.9	17.7	8.2	1.2	8.9	12.4	2.4	81.3
		NI	0	0	0	6.6	0.7	0	3.2	13.6	24.1

Table 2.4-3 Route Residual Impact Summary

Route	Link #'s in Subroute	Residual Impact	Soils	Paleo	Land Use	Geohazard	Biological	Visual	Cultural	Water	Total
A	1,3,5,23,24	H	0	0	0	0	0.6	6	0	0	6.6
		M	7.7	0	2.5	0	14.1	12.2	0	1.8	38.3
		L	32.8	35.5	38	23.7	14.9	22.3	31.5	5.3	204
		NI	0	5	0	16.8	10.9	0	9	33.4	75.1
B	1,3,6,10,18,23,24	H	0	0	0	0	0.2	3	0	0	3.2
		M	3.9	0	1.9	0	14.8	11.6	0	0.8	33
		L	33.1	33.2	35.2	11.6	9.8	22.5	25.4	2.2	173
		NI	0.1	3.9	0	25.5	12.3	0	11.7	34.1	87.6
C	1,3,6,11,20,22	H	0	0	0	0	0.2	4.5	0	0	4.7
		M	4.2	0	1.3	0	9.8	8.1	0	0.6	24
		L	30.6	30.1	33.5	10.5	16.2	22.2	27.9	2.8	173.8
		NI	0	4.7	0	24.3	8.6	0	6.9	31.4	75.9
D	2,9,14,16,25	H	0	0	0	0	0.4	18.9	0	0	19.3
		M	4	0	1.2	0	8.5	4.5	0	1	19.2
		L	33.1	34.4	35.9	8.2	22.7	13.7	26.6	3.3	177.9
		NI	0	2.7	0	28.9	5.5	0	10.5	32.8	80.4

E	1,4,8,12,17,25	H	0	0	0	0	0.7	0.2	0	0	0.9
		M	7.8	0	0	0	23.1	12.1	0	1.5	44.5
		L	25.3	31.1	33.1	14.4	3	20.8	23.9	3.9	155.5
		NI	0	2	0	18.7	6.3	0	9.2	27.7	63.9

The five alternatives routes are described and compared below.

Alternative A – Highway 24 Route

This alternative route would travel south from the wind farm collector substation, along Link 1, for approximately one mile. The route would then turn southeast along Link 3 and subsequently Link 5 for approximately seven miles until it reaches an area approximately one mile west of Montana Highway 24 and two miles north of the Glasgow Base Pond Fishing Access Site. The route would then continue along Link 5 south for two miles until it reaches Northern Electric Cooperative's Watley to Fauth 69kV transmission line. At this point the route would parallel the transmission line for approximately four miles south until it crosses Cut Across Road. The route then turns southwesterly until it reaches Jensen Trail. From here the route would parallel Jensen Trail along Link 23 for approximately one mile. The route then turns southwest again until reaching U.S. Highway 2. From this point the route continues southwest along Link 24 where it crosses the Milk River and Montana Secondary 246. The route would then continue to Billingsley Road and proceed west until terminating at the proposed Antelope Creek Substation.

Alternative B – Jensen Trail Route

This alternative route would travel south from the wind farm collector substation, along Link 1, for approximately one mile. The route would then turn southeast along Link 3 for approximately four miles. At this point the route would turn south along Link 6 and Link 11 where it generally follows Cornwell Road. The route would then continue along Link 10 in a southerly direction for approximately ten miles until it reaches Jensen Trail. From here the route would parallel Jensen Trail along Link 10, Link 18, and Link 23 for approximately ten miles. The route then turns southwest again until reaching U.S. Highway 2. From this point the route continues southwest along Link 24 where it crosses the Milk River and Montana Secondary 246. The route would then continue to Billingsley Road and proceed west until terminating at the proposed Antelope Creek Substation.

Alternative C East Central Proposed Action Route

This alternative route would travel south from the wind farm collector substation, along Link 1, for approximately one mile. The route would then turn southeast along Link 3 for approximately four miles. At this point the route would turn south along Link 6 and Link 10, generally following Cornwell Road for approximately nine miles. The route would then continue south for approximately nine miles until it reaches U.S. Highway 2. From here the route would parallel U.S. Highway 2 along Link 11 and Link 20 for

Figure 2.4-5 Alternative Transmission Line Routes

approximately three miles. The route then turns southwest along Link 22 where it crosses the Milk River and Montana Secondary 246. The route continues southwest until terminating at the proposed Antelope Creek Substation.

Alternative D – Britsch Road Route

From the wind farm collector substation, the alternative route would parallel Britsch Road south along Link 2, Link 9, and Link 14 for approximately 21 miles. The route would then cross U.S. Highway 2 and parallel Vandalia Road for two miles. At this point the route would cross the Milk River and Montana Secondary 246 along Link 16. The route would then continue southeast along Link 16 for approximately 10 miles until it reaches Western's Fort Peck to Havre 230kV transmission line. The route would parallel the transmission line east along Link 16 and Link 25 for approximately two miles where it would terminate at the proposed Antelope Creek Substation.

Alternative E – West Central Route

This alternative route would travel south from the wind farm collector substation, along Link 1 and Link 4 for approximately four miles. The route would then turn southwest along Link 4 and Link 8 for approximately 10 miles. At this point the route would turn south along Link 12, for approximately ten miles, while crossing U.S. Highway 2, the Milk River, and Tampico-Vandalia Road. The route would then continue south along Link 17 for approximately eight miles until it reaches Western's Fort Peck to Havre 230kV transmission line. The route would parallel the transmission line east along Link 25 for approximately one mile where it would terminate at the proposed Antelope Creek Substation.

2.5 COMPARISON OF ALTERNATIVES

2.5.1 Wind Generating Facilities

Impact data for the wind farm alternatives is summarized in Table 2.5-1 for review and comparison.

Proposed Action 500 MW Facility (Phases I, II, III, IV)

The Proposed Action would have the greatest number of wind turbines (334 turbines); and therefore would occupy the greatest number of acres of land. The Proposed Action would also have the greatest number of acres of temporary and permanent land disturbance. Additionally, the positive socioeconomic benefits associated with the VCWEP would be greatest under this alternative.

The project would result in a permanent loss of 12.1 acres of agricultural land (dryland cultivated). The project would also visually influence approximately 483,000 acres over an 18 mile radius. Biologically, permanent vegetation losses of 90 acres are expected, annual bird mortality rates of 402-600 (plus 10 raptors), and up to 668 annual bat mortalities. Total loss of deer winter range is 34 acres. Highly erosive soils would be encountered over 37.5 acres. A total of 12 cultural sites were recorded for this alternative.

Combined construction and O&M jobs created for this alternative total 212 with $25.2 million in wages earned.

Alternative A 150MW Facility (Phases I, II)

This alternative would have the least number of wind turbines (96 turbines), and therefore would occupy the least number of acres of land. This alternative would also have the least number of acres of temporary and permanent land disturbance. In addition, the positive economic benefits associated with the VCWEP would be the least under this alternative.

The project would result in a permanent loss of 8.8 acres of agricultural land (dryland cultivated). The project would also visually influence approximately 363,500 acres over an 18 mile radius. Biologically, permanent vegetation losses of 32 acres are expected, annual bird mortality rates of 116-172 (plus 3 raptors), and up to 192 annual bat mortalities. Total loss of deer winter range is 5 acres. Highly erosive soils would be encountered over 19.3 acres. One cultural site was recorded for this alternative. Combined construction and O&M jobs created for this alternative total 118 with $7.8 million in wages earned.

Alternative B – 300MW Facility (Phases I, II, III)

This alternative would have 200 wind turbines. It would represent almost 60% of the size of the Proposed Action and would be roughly twice as large as Alternative A. The temporary and permanent land disturbance would be proportionately greater than Alternative A and proportionately less than the Proposed Action. In addition, the positive socioeconomic benefits would be proportionately less than the Proposed Action.

The project would result in a permanent loss of 11.5 acres of agricultural land (dryland cultivated). The project would also visually influence approximately 421,000 acres over an 18 mile radius. Biologically, permanent vegetation losses of 60 acres are expected, annual bird mortality rates of 241-359 (plus 6 raptors), and up to 400 annual bat mortalities. Total loss of deer winter range is 7 acres. Highly erosive soils would be encountered over 18.2 acres. A total of 5 cultural sites were recorded for this alternative. Combined construction and O&M jobs created for this alternative total 197 with $16.1 million in wages earned.

2.5.2 Transmission Interconnection Facilities

Impact data for the five alternative routes is summarized in Table 2.5-1 for review and comparison.

C Proposed Action Route

Route C, the Proposed Action route, would have relatively low permanent cropland area losses at 2.4 acres. This alternative crosses the third highest number of miles of Farmland of Statewide Importance. This alternative has the second highest number of historic grouse leks (within 4 miles). This alternative has the third highest mileage of Bearpaw

Shale over 8% slope. It has the second lowest number of cultural sites recorded within 0.5 miles of the route, and the second lowest cultural resource rating compared to other routes. Low or no identifiable impact levels would occur for transportation, environmental justice, health and safety, noise, and air quality. This route traverses the most miles of public lands and would be the shortest route of the five alternatives. Surveys will be conducted prior to construction for wetland and paleontological resources.

Alternative A – Highway 24 Route

This alternative would have the highest permanent cropland losses and miles of important cropland crossed. Land use, geological, cultural, biological, and water resources are impacted at higher levels relative to other routes. This alternative has the lowest number of historic grouse leks (within 4 miles) and the highest acreage of temporary and permanent vegetation losses. The most miles of Bearpaw Shale over 8% slope are crossed in this alternative. This alternative also has the lowest number of recorded cultural sites within 0.5 mile of the route, and the cultural resource rating is the highest compared to other routes. Low or no identifiable impact levels would occur for transportation, environmental justice, health and safety, noise, and air quality. Surveys will be conducted prior to construction for wetland and paleontological resources. This would be the longest route of the five alternatives.

Alternative B – Jensen Trail Route

This alternative would have the second highest permanent cropland losses, but the lowest mileage of Farmland of Statewide Importance crossed. The lowest levels of historic grouse leks within 4 miles may be encountered for this route. This route has the lowest number of miles of Bearpaw Shale over 8% slope crossed. The lowest number of miles of highly erosive soils and the highest mileage of hydric soils would be encountered for this alternative. This alternative has the second lowest number of recorded cultural sites within 0.5 mile of the route. Low or no identifiable impact levels would occur for transportation, environmental justice, health and safety, noise, and air quality. Surveys will be conducted prior to construction for wetland and paleontological resources. This would be the third longest route of the five alternatives.

Alternative D – Britsch Road Route

Route D would have the lowest permanent cropland area losses at 1.3 acres, and would cross the least number of miles of CRP lands. This alternative has the second highest number of miles of Farmland of Statewide Importance crossed. This alternative has the highest number of historic grouse leks (within 4 miles), the fewest stream crossings, and the lowest number of miles of Bearpaw Shale over 8% slope crossed. Hydric soil crossings would be lowest for this alternative. Permanent vegetation loss, loss of mule deer winter range, and number of stream crossings would be lowest for this alternative. This alternative has the largest number of miles of high visual impact, and the largest number of recorded cultural sites within 0.5 mile of the route. Low or no identifiable impact levels would occur for transportation, environmental justice, health and safety, noise, and air quality. Surveys will be conducted prior to construction for wetland and paleontological resources.

Alternative E – West-Central Route

Route E would have the third highest amount of acres of permanent cropland loss. This alternative has the second highest number of miles of Bearpaw Shale over 8% slope crossed. This alternative would have the highest loss of acres of mule deer winter range, the highest number of miles of potentially highly erosive soils, and the most stream crossings. Permanent vegetation loss is the second highest and potential visual potential impacts are the lowest for this alternative. The lowest number of highly or moderately sensitive cultural resource sites and the lowest cultural resource rating was recorded for this route. Low or no identifiable impact levels would occur for transportation, environmental justice, health and safety, noise, and air quality. This route traverses the least number of miles of public lands. Surveys will be conducted prior to construction for wetland and paleontological resources.

2.6 MITIGATION MEASURES

Wind Hunter's goal on the Valley County Wind Energy Project (VCWEP) is to minimize effects on the environment during construction of the VCWEP. In addition to the measures discussed in the above sections regarding construction of the VCWEP, the following measures or techniques would be employed as necessary and appropriate to avoid or minimize impacts as part of the VCWEP design. Refer to Chapter 3 for a detailed assessment of VCWEP impacts and an explanation of how and when "Selectively Committed Mitigation Measures" would be use Refer to Table 2.6-1 Selective Mitigation Measures and Table 2.6-2 Selective Committed Mitigation Measures for a list of the mitigation measures

Table 2.6-1 Generic Mitigation Measures

1) All construction vehicle movement outside the right-of-way normally will be restricted to pre-designated access, contractor-acquired access, or public roads.
2) The areal limits of construction activities normally will be predetermined, with activity restricted to and confined within those limits. No paint or permanent discoloring agents will be applied to rocks or vegetation to indicate limits of survey or construction activity.
3) In construction areas where recontouring is not required, vegetation will be left in place wherever possible and original contour will be maintained to avoid excessive root damage and allow for resprouting.
4) In construction areas (e.g., marshaling yards, tower sites, spur roads from existing access roads) where ground disturbance is substantial or where recontouring is required, surface restoration will occur as required by the landowner or land management agency. The method of restoration normally will consist of returning disturbed areas back to their natural contour, reseeding (if required), installing cross drains for erosion control, placing water bars in the road, and filling ditches.
5) Existing improvements will be repaired or replaced if they are damaged or destroyed by construction activities to their condition prior to disturbance as agreed to by the parties involved.
6) Prior to construction, all supervisory construction personnel will be instructed on the protection of cultural, paleontological, and ecological resources. To assist in this effort, the construction contract will address: (a) Federal and state laws regarding antiquities, fossils, plants and wildlife, including collection and removal; (b) the importance of these resources and the purpose and necessity of protecting them; and (c) methods for protecting sensitive resources.
7) Cultural and Biological resources will continue to be considered during post-NEPA phases of project implementation. This will involve pedestrian surveys to inventory and evaluate these resources within the selected corridor and any appurtenant impact zones beyond the corridor, such as access roads and construction equipment yards. In consultation with appropriate land managing agencies specific mitigation measures will be developed and implemented to mitigate any identified adverse impacts on state or BLM lands. These may include project modifications to avoid adverse impacts, monitoring of construction activities, or data recovery studies.
8) Wind Hunter will respond to complaints of radio or television interference generated by the transmission line by investigating the complaints and implementing appropriate mitigation measures. The transmission line will be patrolled on a regular basis so that damaged insulators or other transmission line materials, which could cause interference, are repaired or replaced.
9) Wind Hunter will apply mitigation needed to eliminate problems of induced currents and voltages onto conductive objects sharing a right-of-way to the mutual satisfaction of the parties involved.
10) Wind Hunter will continue to monitor studies performed to determine the effects of audible noise and electrostatic and electric and magnetic fields in order to ascertain whether these effects are significant.

Table 2.6-1 Generic Mitigation Measures (Cont.)
11) Roads will be built at right angles to the streams and washes to the extent practicable. Culverts will be installed where needed. All construction and maintenance activities will be conducted in a manner that will minimize disturbance to vegetation, drainage channels, and stream banks (e.g., towers would not be located within a stream channel). In addition, road construction will include dust-control measures during construction in sensitive areas, as required. All existing roads will be left in a condition equal to or better than their condition prior to the construction of the transmission line.
12) All requirements of those entities having jurisdiction over air quality matters will be adhered to and any permits needed for construction activities will be obtained. Open burning of construction trash will not be allowed unless permitted by appropriate authorities.
13) Fences and gates will be installed, or repaired and replaced to their original condition prior to project disturbance as required by the landowner or the land management agency if they are damaged or destroyed by construction activities. Temporary gates will be installed only with the permission of the landowner or the land management agency and will be restored to original condition prior to project disturbance following construction.
14) A bundle configuration and large diameter conductors will be used to limit the audible noise, radio interference, and television interference due to corona. Caution will be exercised during construction to avoid scratching or nicking the conductor surface, which may provide points for corona to occur.
15) No biodegradable or non-biodegradable debris will be deposited in the right-of-way.
16) If paleontological resources are encountered, mitigation efforts will be developed to protect the resources.
17) Mitigation measures developed during the consultation period under Section 7 of the Endangered Species Act (1973) as amended will be adhered to as specified in the Biological Opinion of the USDI Fish and Wildlife Service.
18) Hazardous materials will not be drained onto the ground or into streams or drainage areas. Totally enclosed containment will be provided for all trash. All construction waste including trash and litter, garbage, other solid waste, petroleum products, and other potentially hazardous materials will be removed to a disposal facility authorized to accept such materials.
19) Wood-Pole H-Frame structures will be used for the transmission interconnection to reduce visual contrasts.
20) The boundaries of sensitive plant populations, cultural resources, and other sensitive resources will be clearly delineated with clearly-visible flagging or fencing.
21) Prior to construction a noxious weed control plan will be developed to prevent the spread of noxious weeds in the project area.
22) All vehicles used on access roads will be washed and cleaned of possible weed seeds before entering or doing construction off the paved highways.
23) Non-specular conductors will be used to reduce visual impacts.

Table 2.6-2 Selectively Committed Mitigation Measures

1) In areas where soils and vegetation are particularly sensitive to disturbance, existing access roads will be repaired only in areas where they are otherwise impassable.
2) In selected areas on public lands, access roads that disturb sensitive features will be rerouted or will cross overland. That is, construction and maintenance traffic will use existing roads or cross-country access routes (including the right-of-way). To minimize ground disturbance, construction traffic routes must be clearly marked with temporary markers such as easily visible flagging. The construction routes or other means of avoidance must be approved in advance of use by the authorized officer or landowner.
3) To minimize ground disturbance and/or reduce scarring (visual contrast) of the landscape, the alignment of any new access roads or cross-country route will follow the landform contours in designated areas where practicable, providing that such alignment does not impact resource values additionally.
4) To limit new or improved accessibility into the area, all new access undesired or not required for maintenance will be closed using the most effective and least environmentally damaging methods appropriate to that area with concurrence of the landowner or land manager.
5) To minimize amount of sensitive feature disturbed and/or reduce visual contrast, in designated areas structures will be placed so as to avoid sensitive features such as, but not limited to, riparian areas, water courses, and cultural sites, and/or to allow conductors to clearly span the features, within limits of standard tower design. If the sensitive features cannot be completely avoided, towers will be placed so as to minimize the disturbance.
6) To reduce visual impacts, potential impacts on recreation values and safety, at highway, canyon, and trail crossings, tower structures will be placed at the maximum feasible distance from the crossing within limits of standard tower structure design.
7) With the exception of emergency situations, construction, restoration, maintenance, and decommissioning activities will be modified or curtailed in designated areas during sensitive periods (e.g., nesting and breeding periods) for endangered, threatened, or sensitive wildlife species. No such activities will occur in the wind farm area or along the selected transmission line route within 1) 1 mile of an active sage-grouse or sharp-tailed grouse lek 2) mule deer winter range during winter months, and 3) within cottonwood riparian winter habitat for bald eagle during winter months. Sensitive periods and areas of concern would be determined in consultation with BLM and MFWP, and activities in sensitive areas approved in advance of construction or maintenance by the authorized officer
8) New access roads constructed in mule deer winter range will be gated during winter months to preclude public access.
9) Placement of transmission lines over ponds will be avoided, wherever feasible.
10) Conduct surveys for sensitive plant species to inventory and evaluate these resources within the selected corridor and any appurtenant impact zones beyond the corridor, such as access roads and construction equipment yards. In consultation with appropriate land managing agencies and state historic preservation officers, specific mitigation measures will be developed and implemented to mitigate any adverse impacts on state or BLM lands. These may include project modifications to avoid adverse impacts, monitoring of construction activities, or data recovery studies.

Table 2.6-2 Selectively Committed Mitigation Measures (Cont.)
11) Greater sage grouse and sharp-tailed grouse lek surveys will be conducted to inventory and evaluate these resources within the wind farm area, selected transmission line corridor, and associated impact zones prior to construction. Specific mitigation measures will be developed and implemented in coordination with BLM and MFWP to mitigate potential adverse impacts. These measures may include project modification and post-construction monitoring. Raptor excluders will be places on all transmission towers that are located within ½ mile of an active lek and winter range.
12) Single-pole tubular steel structures will be utilized to minimize ground disturbance, operational conflicts, and/or visual contrast.
13) To minimize visual contrast, corten steel or wood poles will be used.
14) H-frame structures will be used to reduce the number of new structure contrast and minimize the spans between structure locations.
15) Non-reflective neutral gray colored paints and coatings will be used to reduce reflection, glare, and/or contrast. Turbines, visible accessory structures, and other equipment painted surfaces will be protected so as to preserve the non-reflective paint, or painted immediately before or after installation. Visible accessory structures will be painted with an earthtone finish to reduce visual contrast with the surrounding landscape. No uncoated galvanized metallic surfaces will be used to prevent oxidation and stronger visual contrast.
16) Where security lights are necessary, they will be activated by motion detection to avoid night-time contrast between the project and the night sky.
17) In areas where significant paleontological resources may be encountered, a field inventory will be completed prior to construction activities. The inventory will result in development of specific mitigation measures to avoid adverse impacts, such as monitoring of construction of activities, avoidance, or data recovery.
18) The Project will comply with all appropriate regulations of the Federal Aviation Administration (FAA), and a Notice of Proposed Construction or Alteration form (Form 7460-1) would be required of Wind Hunter pursuant to Federal Aviation Regulations, Part 77. Final locations, structures, and structure heights, including wind turbines, transmission lines, meteorological towers, and construction equipment that might impact air navigation such as cranes used to assemble the towers, would be submitted to the FAA for the Project. The form would be sent to the manager of the FAA Regional Air Traffic Division Office having jurisdiction over the area where the planned construction would be located. If acceptable to the FAA, white lights will be utilized on turbines and towers to minimize the risk of avian collisions. Coordination with the Department of Defense will be conducted regarding the location and potential effects of the Project upon operations in military airspace. The owner/operator of private airports and airstrips potentially affected by the Project will also be contacted.
19) Construction will be timed, whenever practical, to minimize disruption of normal seasonal activities for cropland (planting and harvesting) and non-irrigated pasture/rangeland.

Table 2.6-2 Selectively Committed Mitigation Measures (Cont.)
20) Coordination with landowners, lessees, and companies during final wind farm and transmission line design will be conducted, to the extent feasible, so as to minimize potential land use conflicts with oil and gas leases, permitted sand and gravel operations, natural gas pipelines, proposed water pipelines and maximize the distance between the transmission line and agricultural operations, planned developments, canals, apiaries, and airstrips located within, adjacent to, and near the right-of-way.
21) To the extent feasible, Project facilities, including poles and access roads will be installed along the edges of borders of property. Consultation with the landowner or land management agency will be conducted to identify facility locations that create the least potential for impact to property and its uses.
22) Farmers will be compensated for crop damage and compacted soils will be restored.
23) On agricultural land, transmission towers, and right-of-way will be aligned with field boundaries to the greatest extent practicable and transmission towers will be placed near field boundaries, access roads and fences to reduce the impact to farm operation and agricultural production. Where this is not possible because of irregular field boundaries, the transmission towers will be placed on or perpendicular to the row crops wherever feasible, so that transmission lines do not run diagonally to the crop rows.
24) Cultural resources will continue to be considered during post-NEPA phases of project implementation. A Programmatic Agreement (PA) will be developed by BLM, WAPA, Montana SHPO, Montana DEQ, Montana DNRC, concerned Tribes, Wind Hunter, and other interested parties to ensure compliance with Section 106 of the National Historic Preservation Act (NHPA). This PA will address, among other topics, inventory procedures for the selected alternatives, procedures for evaluation cultural resources, and mitigation measures. Mitigation measures may include, abut not be limited to, avoidance of the resource, monitoring of construction activities, and data recovery.
25) Areas of disturbed soil will be reclaimed using weed-free native grasses, forbs, and shrubs. Reclamation activities will be undertaken as early as possible on disturbed areas.
26) Certified weed-free mulch will be used when stabilizing areas of disturbed soil.
27) Fill materials that originate from areas with known invasive vegetation problems will not be used.
28) Access roads, transmission line corridors, and tower site areas will be monitored regularly for invasive species establishment and weed control measures will be initiated immediately upon evidence of invasive species introduction.
29) Wetland surveys will be conducted during the appropriate season to identify and inventory wetland resources potentially affected by the selected wind farm, transmission line, and substation site alternatives. In consultation with appropriate agencies, develop site specific avoidance and mitigation strategies to minimize potential wetland impacts.
30) In designated areas, wind farm infrastructure will be placed so as to avoid sensitive features such as, but not limited to, riparian areas, and watercourses, within limits of reasonable design. If these sensitive features cannot be completely avoided, infrastructure will be placed so as to minimize the disturbance.
31) A comprehensive wildlife study plan will be developed and implemented in coordination with USFWS, BLM, and MFWP.

	This plan will include pre-construction surveys and post-construction monitoring within the wind farm area and along the selected transmission line alternative. Pre-construction studies will include surveys of 1) sage-grouse and sharp-tailed grouse leks and winter range, 2) distribution and abundance of passerines and raptors, 3) raptor nests, 4) mule deer winter range, 5) bat species, 6) reptiles and amphibians, and 7) swift fox. Post-construction monitoring will include changes in and the distribution and abundance of all species surveyed, including grouse lek use as well as avian and bat mortality at the wind farm. Data from surveys and monitoring will be used to adaptively manage the operation of existing turbines and siting of future turbine strings. Raptor excluders will be placed on transmission towers where appropriate.
32)	To avoid or minimize potential microwave facility line-of-sight communication interference, coordination with the Northern Border Pipeline Company will occur during the determination of specific wind turbine locations.
33)	Construction staging area and pulling sites shall be located adjacent to roads where practical. Coordination with landowners will be conducted to establish construction areas (such as conductor pulling and splicing areas and construction yards) pm non-agricultural land or in areas with less sensitive crops, where feasible.
34)	During Project construction, it will be necessary to remove cattle from areas where blasting or heavy equipment operations are taking place. Arrangements will made with landowners and livestock owners to keep livestock out of these areas during those periods.
35)	A stipulation will be included in easement agreements with landowners along the right-of-way that landowners and/or farmers and ranchers will be reimbursed for the value of the crops lost and the cost of any delay or interruption in necessary farming or grazing practices as a result of any interrupted use of cropland or grazing land.
36)	Construction operations will avoid, to the extent feasible, disturbance of agricultural soil during the wet season (moist soil is generally more susceptible to compaction than dry soil). The use of heavy equipment on agricultural land, will be minimized, to avoid soil compaction.
37)	Placing tower structures at the edge of fields where canals or irrigation ditches are located, will be avoided.
38)	Landowners will be consulted to determine which aerial applicators cover agricultural lands within the vicinity of the wind farm and approved transmission line route. Written notification will be provided to aerial applicators when meteorological towers, wind turbines and the 230kV transmission line and tower structures will be erected. Aerial applicators will also be provided with maps clearly showing the location of the meteorological towers, wind turbines and the 230kV transmission line and tower structures.
39)	During the right-of-way acquisition process, coordination with each affected landowner will be conducted in order to develop an alignment and specific tower locations, to provide clear information about the right-of-way acquisition process compensation and construction and maintenance activities, and to understand landowner plans for use of the transmission corridor area in order to minimize the impact of tower and right-of-way location.
40)	Existing roads will be used to the maximum extent possible, but only if in safe and environmentally sound locations. New access roads will be designed and constructed to the appropriate standard no higher than necessary to accommodate their intended functions (e.g., traffic volume and weight of vehicles). Abandoned roads and roads that are no longer needed will be

	re-contoured and re-vegetated.
41)	Prior to the start of construction, a traffic management plan to MDOT, Glendive District and Valley County will be submitted. The plan would direct and obligate the contractor to implement procedures that would minimize traffic impacts. Routing of construction traffic will be coordinated with MDOT and the Valley County Road Administrator
42)	Oversize or overweight vehicles will comply with applicable state and county requirements, as permitted or required by MDOT and Valley County.
43)	Notice to landowners will be provided when construction takes place to help minimize access disruptions.
44)	Proper road signs and warnings will be used.
45)	When slow or oversized wide loads are in transit to and from work areas, advance signs and traffic diversion equipment will be used to improve traffic safety. Pilot cars will be used as MDOT dictates depending on load size and weight. Permits would be obtained for these oversized or overweight as required by MDOT and Valley County.
46)	Carpooling for the construction workforce to reduce traffic volume will be encouraged.
47)	In consultation with MDOT and Valley County, detour plans and warning signs in advance of any traffic disturbances will be provided.
48)	Flaggers would be employed as necessary to direct traffic when large equipment is exiting or entering public roads to minimize risk of accidents.
49)	Project personnel and contractors would be instructed and required to adhere to speed limits commensurate with road types, traffic volumes, vehicle types, and site-specific conditions, to ensure sage and efficient traffic flow.
50)	During construction and operation, traffic would be restricted to the roads developed for the Project. Use of other unimproved roads should be restricted to emergency situations.
51)	Following construction, or during construction as necessary to maintain safe driving conditions, any damage to existing roadways caused by construction vehicles would be adequately repaired. Repairs will be coordinated with MDOT or Valley County.
52)	Prior to construction of the 230kV transmission line and prior to subsequent maintenance or removal which would require excavation or earth moving activity on Burlington Northern Santa Fe Railway property, Burlington Northern Santa Fe Railway's Communication Network Control Center will be telephoned to assist in determining if fiber optic, communications, control systems or other types of cable are buried anywhere on the premises; and if so, Wind Hunter would contact the telecommunications company(ies) involved and make arrangements with the same for protection of the fiber optic cable prior to beginning any work on Burlington Northern Santa Fe Railway property.
53)	Prior to construction of the transmission line, coordination with beekeepers would occur to minimize potential environmental impacts, and to mitigate general disruption by the construction activities

Table 2.5-1 Summary Comparison of Impacts of Proposed Action and Alternatives

		Ground Disturbance	Agricultural Lands	Conservation Reserve Program Lands (miles)	Prime Farmlands	Other Land Uses Crossed	Residences w/in 1/4 mi.	Residences w/in 5 mi. of windfarm	Residences w/in 10 mi. of windfarm	BLM VRM Classes Crossed	Visual Impact	Socioeconomic Impact	Avian and Upland Bird Impact	Mule Deer Winter Range	Fragmentation of Grassland Ecosystem	Overall Biological Impact	Stream Crossings	Steep Slopes / Geohazards	Soil Erosion Hazard	Wet Soils (miles)	Paleontology Sensitivity	Recorded Cultural Sites	Cultural Sensitivity	Health and Safety Risks	Noise	Dust During Construction
Wind Farm	Proposed Action 500 MW	Temp. 472 ac Perm. 90 ac	52.4 ac. Temp. Disturb Dryland Ag 12.1 ac. Loss of Dryland Ag	None	None	No Identifiable Impact	-	1	24	2 ac. Class II 1052 ac. Class IV	174 Highly visible turbines from WSA Overlook	Peak Jobs - 212 Wages earned - $25,200,000 Taxes generated - $2,940,000 Annual BLM rent - $525,974 State Revenue - $41,000	Low to Moderate Habitat Rating; Highest Potential Avian Impact	Loss of 34 ac.	Highest Windfarm Alternative	Highest Potential Bat Impact of the Alternatives	Headwaters of several small creeks in area. New access road to cross small stream.	Steep Slopes Along Edges of Wind Farm	Disturb 37.5 ac. Highly erodable soils	None Identified	Moderate	12	-	Low	Low	480 lbs / acre / month
	Alternative A 150 MW	Temp. 129 ac Perm. 32 ac	36.1 ac. Temp. Disturbance of Dryland Ag 8.8 ac. Loss of Dryland Ag	None	None	No Identifiable Impact	-	1	24	128 ac. Class II 3233 ac. Class IV	92 Highly visible turbines from WSA Overlook	Peak Jobs - 118 Wages earned - $7,800,000 Taxes generated - $960,000 Annual BLM rent - $50,568 State Revenue - $6,000	Low to Moderate Habitat Rating Lowest Potential Avian Impact	Loss of 5 ac.	Lowest Windfarm Alternative	Lowest Potential Bat Impact of the Alterntives	Headwaters of several small creeks in area. New access road to cross small stream.	Steep Slopes Along Edges of Wind Farm	Disturb 19.3 ac of highly erosive soils	None Identified	Moderate	1	-	Low	Low	480 lbs / acre / month
	Alternative B 300 MW	Temp. 270 ac Perm. 60 ac	49.3 ac. Temp. Disturb Dryland Ag 11.5 ac. Loss of Dryland Ag	None	None	No Identifiable Impact	-	1	24	128 ac. Class II 10,894 ac. Class IV	107 Highly Visible turbines from WSA Overlook	Peak Jobs - 197 Wages earned - $16,100,000 Taxes generated - $1,900,000 Annual BLM rent - $149,020 State Revenue - $27,000	Low to Moderate Habitat Rating Between Alt A and Proposed Action	Loss of 7 ac.	Between Alt A and Proposed Action	Between Alt A and Proposed Action	Headwaters of several small creeks in area. New access road to cross small stream.	Steep Slopes Along Edges of Wind Farm	Disturb 18.2 ac of highly erosive soils	None Identified	Moderate	5	-	Low	Low	480 lbs / acre / month
Transmission Interconnection	Route A HWY 24	Temp. 113 ac Perm. 90 ac	6.1 ac. Perm. loss of ag land No sand and gravel mines	0.9	1.9 mi.	-	15	-	-	6.5 mi. Class IV	6.0 mi. high impact 12.2 mi. moderate	All Transmission Alternatives Equal	3 Grouse Leks w/I 4 mi.	Loss of 8 ac.	Low Impact Parallels Highway 24 for about 1/2 the route	Low Impact	4	1.4 mi. over 8% slope 1.2 mi. thru Bearpaw Shale	9.3 mi. highly erosive soil 7.7 mi. moderate impacts	0.4	Moderate	7 w/i 0.5 Mile Rating 71.0	31.0	Low	Low	480 lbs / acre / month
	Route B Jensen Trail	Temp. 100 ac Perm. 54 ac	5.6 ac. Perm. loss of ag land No sand and gravel mines	1.5	0.9 mi.	-	14	-	-	5.5 mi. Class IV	3.0 mi. high impact 11.6 mi. moderate	All Transmission Alternatives Equal	5 Grouse leks w/in 4 mi.	Loss of 8 ac.	Low Impact Parallels Jensen Trail for nearly 1/2 the route	Low Impact	3	0.7 mi. over 8% slope 0.5 thru Bearpaw Shale	5.8 mi. highly erosive soils 3.9 mi. moderate impacts	0.8	Moderate	13 w/i 0.5 Mile Rating 68.6	25.9	Low	Low	480 lbs / acre / month
	Route C East Central Proposed Action	Temp. 100 ac Perm. 59 ac	2.4 ac. Perm. loss of ag land No sand and gravel mines	None	1.5 mi.	-	6	-	-	12.4 mi. Class IV	4.5 mi. high impact 8.1 mi. moderate	All Transmission Alternatives Equal	9 Grouse Leks w/in 4 mi.	Loss of 16 ac.	Low Impact Parallels Cornwell Road for overr 1/2 of route	Low Impact	4	1.0 mi. over 8% slope 0.8 thru Bearpaw Shale	7.7 mi. highly erosive soils 4.1 mi. moderate impacts	0.6	Moderate	12 w/i 0.5 Mile Rating 65.7	28.1	Low	Low	480 lbs / acre / month
	Route D Britsch Road	Temp. 101 ac Perm. 50 ac	1.3 ac. Perm. loss of ag land Miles of sand and gravel mines 0.4	0.7	1.6 mi.	Crosses 0.4 mi. sand and gravel	1	-	-	1.0 mi. Class II 1.5 mi. Class III 16.9 mi. Class IV	18.9 mi. high impact 4.5 mi. moderate	All Transmission Alternatives Equal	14 Grouse Leks w/in 4 mi.	Loss of 5 ac.	Low Impact Parallels Britsch Road for over 1/2 of route	Low Impact	2	1.0 mi. over 8% slope 0.3 thru Bearpaw Shale	11.0 mi. highly erosive soils 4.0 mi. moderate impacts	0.1	High to Moderate	52 w/i 0.5 mile Rating 69.3	27.2	Low	Low	480 lbs / acre / month
	Route E West Central	Temp. 86 ac Perm. 64 ac	3.7 ac. Perm. loss of ag land No sand and gravel mines	1.4	1.0 mi.	-	2	-	-	1.1 mi. Class III 14.4 mi. Class IV	0.2 mi. high impact 12.1 mi. moderate	All Transmission Alternatives Equal	8 Grouse Leks w/in 4 mi.	Loss of 21 ac.	Low Impact Few existing roads on northern 1/2 of route	Low Impact	5	1.4 mi. over 8% slope 1.0 thru Bearpaw Shale	13.4 mi. highly erosive soil 7.8 mi. moderate impacts	0.4	High to Moderate	39 w/i 0.5 Mile Rating 59.8	22.4	Low	Low	480 lbs / acre / month
Antelope Creek Substation	Proposed Antelope Creek Substation	Temp. 5 ac Perm. 2 ac	None	None	None	-	None	-	-	None	Low impact	All Transmission Alternatives Equal	No identifiable impact	Low to No-identifiable Impact	Low Impact	Low Impact	No wetlands or streams present.	None Identified	None Present	None Present	Moderate	-	High; known resources adjacent to site	Low	Equal to noise levels at existing station.	480 lbs / acre / month
No Action	No Action	No Identifiable Impact	No Identifiable Impact	No Identifiable Impact	No Identifiable Impact	No Identifiable Impact	No Identifiable Impact	No Identifiable Impact	No Identifiable Impact	No Identifiable Impact	No Identifiable Impact	Jobs not created, taxes not generated, rent not generated.	No identifiable impact	No Identifiable Impact	No Identifiable Impact	No Identifiable Impact	No Identifiable Impact	No Identifiable Impact	No Identifiable Impact	No Identifiable Impact	No Identifiable Impact	No Identifiable Impact	No identifiable impact	None	None	No Identifiable Impact